STATUS OF RESEARCH IN AMERICAN GEOGRAPHY

One of a series of ten reports prepared by Committees of the Division of Geology and Geography, National Research Council, under contract with the Office of Naval Research

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ECONOMIC GEOGRAPHY

Raymond E. Murphy,
Chairman

DIVISION OF GEOLOGY AND GEOGRAPHY
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This is one of ten reports prepared to evaluate and describe the current status and future potential of research in various fields of American Geography. The coordinators of the study were Preston E. James and Clarence F. Jones.

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ECONOMIC GEOGRAPHY

INTRODUCTION

Economic geography is a large branch of a subject that is itself a veritable Sequoia in the academic field. Like physical geography, economic geography's breadth is so great it includes what seems to be a whole group of branches rather than a single limb of the tree. But the subdivisions of economic geography form a more coherent whole than do those of physical geography. Though they may range from a study of a nation's natural resources to a detailed consideration of certain aspects of marketing geography, still they have a common focus: all are concerned with describing and explaining areal patterns of economic activity.

Economic Geography's Evolution in the United States

Economic geography, like the study of all aspects of human geography in the United States, is a newcomer. There are instances of field work and geographic writing done nearly a century ago that are now recognized as valuable beginnings. But economic geography as a field of American research can hardly be said to have existed before the Twentieth Century.

For the first two decades of the century American economic geographers were interested primarily in trade and commerce: tons of coal, bushels of wheat, pounds of coffee. A country with small foreign trade got little attention in those days. Economic geography writings from this period were largely commodity studies, confined to cataloging statistical information, and, like other phases of human geography, were unsupported by detailed field

The committee which prepared this chapter is as follows: J. W. Alexander, W. Applebaum, C. C. Colby, C. Harris, P. E. James, C. F. Jones, H. Mayer, R. E. Murphy, Chairman; H. H. McCarty, R. S. Platt, V. Roterus, J. A. Russell, E. L. Ullman, J. R. Whitaker, A. J. Wright, and C. M. Zierer.

work. High lights among the publications before World War I were J. Russell Sm ih's "Industrial and Commercial Geography" and "Geography of the World's griculture" by V. C. Finch and O. E. Baker.

The years between the two world wars were particularly productive. Classification of agricultural land use received wide attention, and a series of articles on the agricultural regions of the various continents began in Economic Geography in 1925, the first year of the magazine's existence. These studies, of course, dealt with vast areas, and most of the regions were large enough to be shown on small scale maps.

But this was only a beginning. The field expanded rapidly during the years between the two wars. Land classification was carried into greater and greater detail and appeared on lar er and larger scaled maps, and with this came new techniques and methods of geographic field mapping. "Go to the field," became a watchword of the times. Going to the field year after year led to an important discovery. Gradually the realization came that areal patterns of economy are dynamic entities, not merely static distributions based on areal homogeneity. And this idea led quite naturally toward putting geography to practical use, a move that received great impetus by the need for planning that grew out of the depression.

As the years passed, economic geography grew in breadth and depth. It became apparent that here was a whole group of fields rather than just one, and a definite literature for many of the individual branches began to appear. As time went on these specialties became more and more definite, focused upon more specific aims. The trend toward specialization in economic geography was given a tremendous impetus by the needs of military and strategic planning during World War II.

General economic geography ceased to exist as a research field. As Finch puts it, "No one is so versatile that he may claim a complete mastery of this field." /1/. More and more the man who claims penetration in his research thinks of himself as a specialist in land utilization, in resources, in manufacturing geography, in the geography of transportation, or in some other special branch, and makes no pretense to research competence in the field as a whole. With recognition of these specialties has come the realization, too, that each requires a particular background on the part of the investigator.

Central Theme of Economic Geography

Hundreds of American geographers call themselves economic geographers, and the field of economic geography is represented by a rapidly growing and abundant literature. With so many adherents and so large a literature one should expect varying points of view to be expressed. Nevertheless there is much common ground. The economic geographer studies spatial distribution patterns of economic activities in relation to other significant patterns. Since he invariably deals with an area, though it may in fact be the entire earth's surface, he is concerned with the combinations of phenomena that characterize areas or places. And he does not stop with static patterns, but includes the study of the processes of change, whether in progress or potential, and of the interrelations between areas.

In many earlier studies, patterns of economic activity were considered chiefly in relation to elements of the natural environment. More recently, however, the feeling has grown that all relevant patterns whether natural or cultural should be given due weight in enterpretive economic phenomena.

Importance of Quantitative Data

Like climatology, economic geography depends to a considerable degree upon statistical data. When necessary, the geographer must collect his own data, but his potential is enormously increased when such material is already available to him. Foremost among American statistical sources are the publications of the United States Bureau of the Census. In spite of limitations in this source of data, which may hamper some lines of research, economic geography could not have achieved its present level without it. But the need for detailed field work to supplement census or other statistical data is more generally recognized than it was during the first years of the century. And it is now a common practice to gather and organize data in map form, not merely to supplement or illustrate the statistical material, but for the purpose of cartographic analysis and the discovery of area relations.

Relation to Economics

Since the economic geographer deals with man's means of gaining a livelihood it is obvious that his work, more than the work of other geographers, touches upon that of the economist. Several decades ago O. E. Baker wrote," . . . Geography, the mother of the natural sciences met economics, the father of the social sciences, and, almost unconsciously, a deep affection has developed. Thus we have a new hyphenated subject . . . economic geography . . ." /2/ Unfortunately, this implied spirit of cooperation between the two disciplines has not fully materialized. The economist too often pursues his way with little regard for the assistance the geographer can give him.

But more serious from the geographic point of view is the lack of a knowledge of economics on the part of many economic geographers. Unlike

economic geology or economic botany, where the adjective denotes merely an interest in the practical application of the discipline, economic geography deals in large part with man's means of gaining a livelihood, which is also near the heart of economics. The conclusion is inescapable that, although the economic geographer should be first of all a geographer, a comprehensive grounding in economics is essential. The statement of a recent writer, "Absence of economics in the economic geographer's training is only comparable to absence of geology in the training of the geomorphologist," /3/ comes close to the truth.

Applied Research in Economic Geography

To many the term "economic geography" suggests utility and practicality Though this is an obvious misinterpretation, it does happen that economic geography has far greater possibilities of practical application than most other fields of geography. In applied research the economic geographer's efforts are directed toward the solution of specific practical problems. Such questions are asked as: What better use can be made of this land? Where can productive capacity and sales outlets be located to best reach present and future markets? What programs will result in better use of this resource? Such research requires the special methods and knowledge of one or another of the branches of economic geography.

Unfortunately, the possibilities of practicality carry with them corresponding dangers. As Finch puts it, after summing up the average performance in economic geographic research, " . . . Some writings on economic geography go farther and attempt the solution of problems in the proper distribution of industry and the establishment of principles capable of broad application in areal comparison. Too often the solutions are inadequate and

the principles lack soundness . . ." /4/.

So far sound practical applications of economic geography have not been numerous, but there have been some notable examples. Resource specialists have rendered valuable government service, land use surveys by geographers have helped to solve the problems of areas, and economic geography has found its way into marketing through the activities of several capable geographers. As the field of economic geography matures and the subject's potential contributions become better known, it should play a much more active role in business and industry than it does now. Such practical applications unquestionably add vitality to both basic and applied work in the field.

Conclusion

The preceding paragraphs have dealt with the evolution of economic geography, with the point of view of the subject, and with some of its special aspects. Obviously, economic geography is a vigorous field in American geography, with many workers and a substantial literature. It is the purpose of this chapter to assay the work that has been done and to point out challenging paths for the future.

Research in economic geography has a number of branches, each of which has come to have its own concepts and its own specialists. These branches, as we see them while this chapter is being written, form the subjects of the following sections.

1. Finch, V. C. "Training for Research in Economic Geography," Annals of the Association of American Geographers, Vol 34 (1944), pp. 207-215. Reference on p. 207.

2. Baker, O. E. "Economics and Geography," Papers and Proceedings of the Thirty-eight Annual Meeting of the American Economic Association, The American Economic Review, Vol. 16, No. 1 (March, 1926), Supplement, pp. 112-114 Reference on p. 113.

3. Robertson, C. J. "Economic Geography and Economics," Geography, Vol. 35, (1950), pp. 38-41. Reference on p. 40.

4. Finch, V. C. op. cit., p. 207.

RESOURCES

Economic geographers are always mindful of resources, whether their immediate activities are focused on resources or not. Accordingly, it is appropriate to consider the subject at some length in an analysis of the progress and prospects of American economic geography.

Resources are treated by many disciplines. Any attempt to survey the scope of resources study in universities, for example, will lead one through a wide range of academic endeavor, from economic geology to English poetry. The study of resources is already considered a major responsibility of several disciplines, and there are signs of an emerging discipline organized around resources as the central object of investigation /5/.

American geographers have had a major part in the growing concern with resources. Indeed, their interest in the resource base of American life has kept pace with national expansion, antedating the twentieth century emphasis on resource problems although greatly stimulated by it.

The United States offered geographers a fruitful field for the study of resources. It provided a large sample of the world's new lands, where information about resources has been an essential to successful settlement. It also furnished ample opportunity for study of the destruction of natural resources. During the present century Americans have been active in the movement to counteract destruction of natural resources and to maintain them at levels commensurate with current and anticipated needs. They also have been prominent in the scientific analysis of both natural and human resources; and have set a rapid pace in the commercial use of natural resources.

The Scope of Resources

Resources have been defined by Erich Zimmermann as "those aspects of man's endowment and environment upon which people are dependent for aid and support" /6/. Unfortunately, we all are too likely to limit such a definition to those aspects which lie within our particular interest. Viewed broadly, it is possible to recognize at least three chief categories of resources: 1) those derived from the physical and biological conditions of the land, which we call natural resources; 2) those derived from the population in the sense of manpower, or human resources; and 3) those derived from the attitudes, objectives, and technologies of the people, which we call cultural resources.

Natural resources are the materials provided originally by non-human agencies. The word resources, however, implies something which has proved useful to man. As Jan O. M. Broek has stated, "An element of the natural environment becomes a resource only when man recognizes it as useful" /7/. Erich Zimmermann has developed more fully than anyone else the concept of resources as "purely functional, inseparable from human wants and human capabilities" /8/. Carl O. Sauer remarked that "the term 'resources' implies the determination that the thing is useful and therefore a cultural achievement" /9/. It is helpful in this analysis to follow Zimmermann /10/ in speaking of natural conditions as essentially neutral stuff into which man drives a wedge of culture. In so doing, he converts some aspects of the neutral stuff into resources, but at the same time he meets new resistances. This functional approach to earth conditions is not new to economic geographers; indeed, it is the very essence of their approach. Significant in this connection is the heavy reliance of Zimmermann's book, especially the first edition, on the work

of economic geographers.

If one takes literally the definition of resources as framed by Zimmermann, one must also include man himself. Certainly man provide aid and support to other men. Within certain limits, moreover, human resources can be substituted for those derived from the earth. To distinguish earth-derived resources from human resources is so useful in both theory and action, that it seems desirable to continue to recognize these two categories.

The third category of resources results primarily from what man himself does, and in large degree from his learned behavior. Accordingly, we label these cultural resources, fitting our terminology into the customary usage of the word cultural by social scientists. Cultural resources may be divided into two groups: the elements of material culture, such as houses, roads, tools or machines; and those of non-material culture, such as economic social and political institutions, religious ideas, or group attitudes.

Like all classifications, this one is useful if not followed too rigidly. Each of us can think of resources that fall rather neatly into each category; on the other hand, we can easily identify resources that are clearly gradational. Virgin soil is clearly a natural resource for an agricultural people; roads are a cultural resource; a canalized river, or a soil modified by use, lie somewhere between natural resources and cultural resources. Similarly one might show gradations between other classes. A highly skilled technician is a human resource, but he also reflects a large measure of our technical (non-material) culture; and he can do his work only with the tools and machines (material culture) at hand.

In actual practice it is customary to focus attention on one of these resource classes and to have the others less sharply in mind, or to include

only their margins. The term natural resources thus commonly includes not only the original earth conditions that have become significant to man, but also earth conditions which have undergone significant modifications. We consider soil a natural resource, even though man may have greatly changed it; and similarly we include other resources that have been greatly modified. In brief, the label, natural resources, is interpreted broadly enough to include what Zimmerman has called natural-cultural resources /11/.

In rounding out the definition of resources, two other points should be considered briefly. Fundamental is the fact that resources never occur singly. Not only do these major groups of resources function together, but each group is normally a collection of resources. To illustrate the first point, one completely misjudges the development of New England unless human and cultural resources are recognized as of paramount importance. It is a truism among geographers, too, that iron ore is of relatively little use unless it can be assembled with coal (coke) and limestone at relatively low cost. Thus the distributions of resource combinations are of critical significance.

A second consideration applied particularly to economic geographers and further restricts the scope of the term resources in this analysis. In general, American geographers who have been interested in resources have focused attention on the natural (and natural-cultural) ones, and the other categories, man-power and material and non-material culture, have been marginal. More precisely, we have considered man as the agent, conditioned by his non-material culture, utilizing the natural resources to produce his material culture. An assessment of past performance indicates that economic geographers have focused their attention chiefly on the earth conditions, both original

and man-modified, as valued and used by particular peoples. In the future a broader attention to the whole resource complex characteristic of particular places may prove rewarding.

Resources in American Geography

Geographers recognize that in some measure all of the phenomena with which they deal are also the concern of some persons in other disciplines. This is certainly true of resources. Not only that, but resources are becoming the center of an organization of fact, principle, and procedure that cuts across established disciplines; or, to put it another way, an area of endeavor into which various specialists have moved, there to work together under a different frame of reference from that in the disciplines of their original preparation. This new field is one of action as well as theory, and is unified by purposes and history. It is in a sense a higher level of elaboration and organization of knowledge than is, say, geography or agronomy. One should recognize, accordingly, that many American geographers who study resources have been working not only in their own discipline and among their own brethren but that they not uncommonly cooperate in an organization of scholars and practitioners that transects their field but which is nevertheless organized along geographic lines because of its attention to the association of phenomena in particular places. Pertinent to both roles are the bases of the geographer's interest in resources and of his competence in dealing with them.

Bases of Concern and Competence

1. Of primary importance in the study and management of resources is the concern of the geographer with individual elements of the earth's surface (more precisely, of the life layer of the earth) as these elements are

distributed over the earth and as they are associated in particular places. We are concerned in physical geography with earth conditions, whether resources or not; the utilization, destruction, and betterment of these earth conditions are the concern of the economic geographer.

2. Fundamental to the geographer's approach is his traditional interest in man's dependence on nature. It falls to the geographer, among students of human behavior, to analyze these relationships as they exist in space and time. Yet the economic geographer well knows that the identification of a dependence of man on nature is but the beginning of his problem. He has still to analyze man, his wants, his capacities, and his geographic situation in order to understand how the given dependence came about.

3. Geographers have been among the foremost workers in earth science in the study of man's effect on nature. Moreover, geographers are concerned with all changes in nature, whether those changes affect the current usefulness of earth conditions or not. The physical goegrapher would certainly disavow any restriction of his study of the earth to matters clearly of functional significance. On the other hand, the economic geographer quite logically is primarily interested in those changes which increase or decrease the resource value of an area.

Since the days of George P. Marsh /12/, who became interested in the modification of earth conditions by man at least one hundred years ago and who relied heavily on European geographers, many Americans have given sharp attention to resource destruction and betterment. It is perhaps unfortunate that we look to Gifford Pinchot, inventor of the phrase "Conservation of natural resources," /13/ and fail to look still farther back to distinguished scholars, Europeans as well as Americans, who worked on the problem but did not invent

the label. The geographer will recall not only the work of Marsh but also that of Nathaniel S. Shaler /14/, Carl O. Sauer, and others.

4. A major contribution of geographers in dealing with resources emerges from their attention to the interrelations of unsystematically associated phenomena in particular places. Geographers have been able to bring broad perspective into problems of resource-use planning. The geographic approach facilitates the investigation of resource conflicts and the planning of cooperative combinations of resources. Geographers can do much to clarify conflicts and to suggest remedies: for example, in the conflict between mining and surface land use; in the struggle between those who favor water conservation and those who want more cheap grazing land; or in the differences between promoters of unrestricted hunting and fishing privileges and the proponents of game and fish preservation. One of the more active participants in this work in the last twenty years told a member of this committee that as late as 1930 he found relatively little awareness among non-geographers of the various interrelations involved in water resource planning. There was, for example, virtually no recognition of the unity of individual watersheds, whereas such unities are of the very essence of the geographer's thinking.

Established Place of Resources in American Geography

In American geography resource study appears in at least three connections: 1) as a part of the study of man-land relations; 2) as a part of the practical work of land classification and use inventory; and 3) in the study of the patterns of economic production and trade.

1. The history and theory of man-land relations have made up a significant sector of geographic thought. This constituted a part of the

analysis of so-called geographic influences (Ellen C. Semple), geographic adjustments (Harlan H. Barrows), and area relationships. On these themes virtually all students of the philosophy of geography have had their say, from the earliest American geographers to contributors of this volume.

2. The inventory and appraisal of natural resources have been a major concern of American geographers. From the initial settlement of our country, and from the very beginning of geographic interest in America, one of the tasks that has constantly beset Americans has been the making of inventories and appraisals for the areas into which we have moved. The somewhat crude and undifferentiated analysis of early years gave way in the late 1800's to the work of specialists on individual resources, and the overall evaluation suffered somewhat. In the last thirty years, however, geographers have been utilizing the findings of specialists and applying these findings to the study of resource complexes in specific localities.

To understand the functional significance of resources the study of the time sequence is essential. Historical geography, in which the changing significance of resources in specific areas can be analyzed, has thrown new light on man's relation to the land and has developed new concepts to guide geographic research. Regional geography, in its revival in the 1920's, directed attention very sharply to the ~~the~~ resource base of specific areas, giving attention not only to regional advantages but also to regional liabilities or resistances according to Zimmermann. Here, also, the time perspective brought new illumination to regional analysis.

Somewhat eclipsed during the 1920's by regional geography, political geography was cultivated with renewed and increasing vigor in the 1930's and 1940's, and took as one of its principal themes the national endowment of the

countries considered. This emphasis on national endowment, on the resource inventories of politically organized areas, is in accordance with the mid-twentieth century preoccupation with the goals of national autarchy; it is still a phase of the study of the resource base of specific areas or regions, only here the region is defined in political terms.

Quite at the other end of the geographical scale is detailed land classification, a theme developed in a later section of this chapter. Detailed land classification is being carried forward in large part by students of closely related fields. For the economic geographer, much of this work is microgeography of high quality. Gradually workers in land classification have come to accept a conclusion which many geographers have long held, namely, that land should be classified in terms of specific uses; in other words, that land classification should conform to the concept of a resource as something useful for a specific purpose under specific conditions. Noteworthy in the pioneering work in this country in land classification was that carried out for the Michigan Land Economic Survey in the 1920's.

Some geographers have been watching the rising standards of living over the world in relation to the various limits set by natural resources. Moreover, we are reminded by members of our field that the limits to resources are cultural, as well as natural. As some opportunities disappear with the filling up of hitherto unoccupied lands, others are created by technical advances. Even though we accept the "closed-space" thesis of Frederick Jackson Turner and others, James C. Malin warns us not to assume a closing out of opportunities for expanding resources and their services to us /15/.

The geographer's contribution to inventory and appraisal of resources is thus many-sided and wide-ranging. It runs the scale from

Richard J. Russell's study of desert rainfall /16/, to the recent study, under Edward A. Ackerman's direction, of Japan's natural resources, a thorough inventory and evaluation of a nation's resources in terms of its needs and capacities /17/.

3. Much of the work of economic geographers with resources is a normal phase of their study of production and trade. It occasionally happens, moreover, that an investigator who is primarily connected with economic production may devote a considerable part of his time to preliminary works on resources. In addition, there are certain phases of productive use of resources that give especial attention to the resources themselves, namely, the so-called extractive industries, in which the product is a part of the resource actually removed from its place in nature. Thus, any study of the forest industry or the fishing industry of necessity gives a great deal of attention to the resources being exploited.

Resources as a Special Field

In this analysis of the part resources have had in the development of American geography as a whole and of economic geography in particular we have paid attention only to the study of natural or earth-derived resources, in original and in altered form. This is the aspect of resource study most commonly cultivated by geographers, presumably because geographers normally are trained not only in the economic side of their field but also in the physical side. The concluding part of our analysis centers very directly on resources as a special topical field of geographic study, with consideration of methods, achievements, and prospects.

Methods

In the investigation of natural-resource problems the usual methods of the geographer are all utilized: Field observations, interviews, statistical and cartographic analysis, and the study of historical documents. It is perfectly clear to any geographer who analyzes such a paper as Arthur R. Hall's "Two Centuries of Soil Erosion in the Piedmont Cotton Belt," /18/ that all of these methods are essential. As in other sub-fields, the relative balance will depend on the specific problem, as well as on the bent of the investigator.

In view of the scope of resource analysis and its importance in action programs, it is desirable to stress the increasing degree to which geographers can and do depend on the work of specialists in related fields. As previously noted, we have moved from a somewhat general, undifferentiated study of earth conditions in Marsh's day through a period of fragmentation and specialization to a second period of comprehensive views, based in our time not only on the investigator's own observations but also on those of others. Moreover, as research is carried out by groups of workers, whether under the direction of governmental agencies or not, it becomes increasingly possible for the geographer who operates as a resource generalist actually to direct lines of investigation by co-workers in related disciplines. Here is an opportunity for team research consistent with research patterns developed during World War II.

Achievements and Opportunities

The foregoing analysis of the place of resources in American geography as a whole identifies or implies some of the principal achievements and inviting prospects in the special field of resources. These will be stated more

sharply now in terms of 1) long-time developments, 2) strong developments since World War I, 3) good beginnings needing vigorous support, and 4) major opportunities along little developed lines.

1. Long-time developments. At least three long-time developments in the field of natural resources were identified in the above analysis. These are restated below.

a. From the beginning of American geography there has been sustained inquiry into the nature and geographic distribution of natural resources.

b. Throughout the nineteenth century and on to the present, American geographers have been concerned with resource appraisal for specific areas.

c. For more than a century, study of the depletion and conservation of natural resources has continued, but with uneven emphasis. It now appears that the main line of descendence from Marsh, the principal of the pioneers, crossed to Europe and passed through Alexander Woeikof and Ernst Friedrich to Jean Brunhes, and from Brunhes back to this country to appear in the work of many of our contemporaries /19/. The scope of Marsh's study, world-wide and richly elaborated, has been matched in no subsequent work, although occasional essays, as by Sauer /20/, are in the Marsh tradition. The main American stem out of the Marsh root, however, has concerned the natural-resource base of the United States.

2. Strong developments since World War I. During World War I the efforts of American geographers were channeled to a large degree into wartime activities. Moreover, the interest of non-geographers in resources was likewise subordinated to the exigencies of war. The return of geographers to academic posts and the shift of American political leaders back to internal problems set the stage for a strong development along many lines.

a. The systematic analysis of the natural resources of the United States and their conservation expanded rapidly and became an important part of school and college education in this country, with geographers taking a leading place in writing and teaching / 21/.

b. During the 1930's there developed a keen appreciation of the interrelation of various items in resource complexes, and appreciation to which our regional geographers and participants in regional planning have made major contributions.

c. The region as an operational unit in resource management has received much attention. The regional approach to American problems was greatly accelerated during the 1920's and 1930's, springing up almost independently in various desciplines. It is not too much to say, however, that geographers have made notable contributions to this aspect of resource study, in terms not only of equipment of regions but also in setting up geographic frames for resource management.

d. Another strong development in the period immediately following World War I was the growth among geographers of an awareness of resource management as an action field, and an appreciation of the opportunities and responsibilities of geographers, particularly as resource generalists. This is a revival of the spirit of John Wesley Powell appearing in the work of Harlan H. Barrows, Kenneth C. McMurry, G. Donald Hudson, and others. Some are content to stop with making clear the pertinence of geographic findings to particular policies, but others are concerned primarily with the actual guidance of regional develcpment. In referring to the rise of like purposes in France, Jean Gottman writes, "Demangeon asks of a geographical study that it draw conclusions as to the possible improvement of existing conditions."/22/ And

this is becoming more and more a general tendency in the geographer's endeavor to achieve his part in what Isaiah Bowman called "the creative experiment" /23/.

e. Among the major developments in this period between the two world wars was the contribution to the subfield of water resources, into which geographers have moved with exceptional vigor in the last twenty years. Perhaps one might take as a landmark of early achievements the report /24/ of the Mississippi Valley Committee, on which Barrows had a place. Indications of more recent achievements in this field were the presence of Gilbert F. White on the President's Water Resources Policy Commission; the direction of Volume II of the Commission report, a voluminous work, by Edward A. Ackerman; and the cooperation of a number of other geographers in the work of the Commission /25/. No discipline has grown up to cover all of the aspects which come to the fore in any functional analysis of water problems. It is into this gap that many geographers have moved with considerable vigor and notable results.

3. Good beginnings needing vigorous scholarship. As one turns to promising lines of study and application with as yet relatively little accomplishment, one is moving gradually from an evaluation of achievements to an identification of open gates and inviting vistas, with corresponding room for greater difference of opinion. We may content ourselves with four suggestions in identifying good beginnings needing vigorous scholarship.

a. The definition and mapping of vegetation types have lagged behind the work on other resources. Although the native vegetation has undergone wholesale alteration over large parts of the world, there are still vast areas for which such information makes a highly significant addition to our knowledge of resources. Similarly we are working with water resources with

inadequately formulated concepts to guide us, and with essentially no body of literature which describes water resources in a systematic way, whether for our own country or the world as a whole.

b. Americans need to appraise resources in the outlying parts and dependencies of the United States. The long-time vigorously supported analysis of the resources of the continental United States has not been matched by corresponding achievements in other parts of our national domain. Geographers are moving rapidly to close this gap for Puerto Rico, and significant beginnings have been made in Alaska; but much remains to be done.

c. Case studies are needed at every hand, studies of the functioning of particular resource combinations, of resource depletion, and of resource management, whether successful or unsuccessful by current standards. In discussing river floods, Gilbert White pleads for intensive studies of adjustment to floods in this and other countries, in order to identify the conspicuously successful and unsuccessful adjustments for each important type of floodplain and of floodplain occupance. We recall in this connection the incisive study of drainage in the lower Mississippi by Walter M. Kollmorgen /26/.

Especially needed for shaping policies and action programs are case studies by independent investigators of controversial aspects of resources development. Too commonly the assessment of resource needs and resource treatment has been made by persons who have not been free, because of the avowed interests of the organization or persons for whom they are working, either to carry out disinterested inquiry or to publish the results of their findings. Geographers not only have the competence and interest for making such case studies, but a large proportion of them likewise are essentially impartial.

d. Geographers might well expand their study of resource problems to include great geographic realms such as the rainy tropics. Karl J. Pelzer and Earl P. Hanson have worked in this direction, as have also Charles E. Kellogg and Robert L. Pendleton. As yet, for example, no one has provided us with a comprehensive and comparative study of the impact of shifting cultivation on soil resources for the rainy tropics as a whole.

4. Some major opportunities where little has been done. American geographers who have entered the profession within the last ten years appear to have given relatively little attention to resources as a special field, however much they have been concerned with resources as relevant to an understanding of productive occupance or even of urban development. A check of doctoral dissertations and of articles in The Geographical Review, The Annals of the Association of American Geographers, and Economic Geography will substantiate this conclusion. It would appear, therefore, that there is ample room for many more American geographers to direct their attention quite sharply to some of the problems which resources present. A list of major opportunities along lines where relatively little has been done can not be much more than an identification of the more obvious openings.

a. Investigations of the recreational value and use of resources and of the scenic aspects of resources would appear to present a peculiarily appropriate opportunity for the geographer, depending, as such conditions do, on the total regional complex.

b. As the study of mineral geography moves forward, there is an opportunity to analyze the impact of mining on other resources and the development of policies which will take social as well as market values into account. There has been a tendency to leave the field of non-renewable

resources to the engineer and to the geologist. While in no sense wishing to belittle the contributions of other workers in disciplines, we must emphasize also the need for the geographic study of mineral resources. It is interesting in this connection to recall Charles R. Van Hise's statement in the preface of his conservation book over forty years ago, that he hoped that it would not be long until there would be separate handbooks dealing with each major group of resources in terms of their destruction and conservation /27/. Gradually through the years these gaps have been filled save one: there has been no comprehensive attempt to deal with the conservation of mineral resources in book-length detail.

c. Historical physical geography, including natural resources, has been little cultivated. What, precisely, has happened to soils or waters over a considerable length of time? Indeed, we have increasing reason to wonder regarding the nature and extent of modification by the American Indian of the so-called natural conditions of this country. All too commonly geographers have rather naively assumed that the white man found a virgin continent. The English schoolmaster, Thomas Arnold, clearly phrased the basic question when he wrote, "How much we want a physical geography of countries, tracing the changes they have undergone either by such violent revolutions as volcanic phenomena, or by the slower but not less complete changes produced by ordinary causes: such as alteration occasioned by enclosure and drainage, alteration in the course of rivers, and in the level of their beds, alteration in the animal and vegetable products of the soil, and in the supply of metals and minerals, noting also the advance or retreat of the sea, and the origin and successive increase in the number and variation in the line of

roads, together with the changes in the extent and character of the woodland" /28/. Such a lively interest in the historical geography of resources and physical conditions should put many an American geographer to shame.

d. There is need to enlarge the scope of resource-management studies to include the comparative study of small areas and the study of areas that are larger than localities but smaller than countries. We know relatively little as yet regarding the reasons why national policy and resource use are not equally effective in all parts of the United States.

In connection with the need for resource-management studies of enlarged geographic scope is the clearly urgent need for materials on a regional and a state level. In the United States a large measure of resource management is the function of the individual states. In a number of them educational programs to match that responsibility have been developing rapidly. It is still true, however, that only a comparatively few states have attempted to provide suitable teaching materials for the resources of the state as a whole /29/; and even scarcer are teaching materials which cover the resources of state subdivisions. It would seem, in this connection, that contrasts resulting from varying state policies would be a challenging and rewarding line of research combining political geography and the resource field.

e. The identification and description of types of resources associations and of types of geographic patterns of resource depletion and conservation, and the mapping of those types, have scarcely begun. We have world-wide climatic classifications, classifications of agricultural modes of land use, etc., but classification and mapping focused on these additional phases of resource analysis have lagged far behind.

f. Through American geography runs a reasonably adequate emphasis on

natural factors in man's relation to the earth; but relatively slight attention has been given to cultural factors. This same weakness appears in the special field of resource management. Indeed, this presents an even greater need for the reason that many of the more vigorous and productive students of resources are in the natural sciences, where their bent, training, and problem formulation may leave cultural factors out of consideration. The geographer, at least the economic geographer, should give much attention to cultural factors in man-resource relations, and should most certainly be able to evaluate culture as an aid or hindrance to desired changes in resource use. There is no good reason why economic geographers should not move vigorously to fill this gap.

g. Throughout most of this section, beginning with the concern and competence of geographers with resources, it has been assumed that we have been dealing with earth resources, both the unaltered and that modified by man. The preoccupation of geographers with natural resources is harmonious with the development of American geography as a whole. It does not appear, however, to be justified by the logic of our discipline. There is now no good reason why geographers should fail to give direct sustained attention to the areal differentiation of human resources and of resources of material and non-material culture. Much of our failure properly to judge the vitality of the economy of regions stems from lack of attention to human and cultural resources. A word of warning is appropriate. Where man is directly involved, as in the study of human and cultural resources, objectivity is vastly more difficult to attain than in the study of earth resources. But this very difficulty presents a challenge. Work along this line would surely reward geographers who are competent to deal with man's handiwork and with man himself

5. Witness the new School of Conservation, Yale University, and the School of Natural Resources, University of Michigan.

6. Zimmermann, E. in Drummond, L. (Ed). Texas Looks Ahead. Vol. 1, Austin, 1944, p. 1.

7. Broek, J. C. M. "The Relations Between History and Geography," The Pacific Historical Review, Vol. 10 (1941), p. 322.

8. Zimmermann, E. World Resources and Industries. Rev. Ed. New York, 1951, p. 10.

9. Sauer, C. O. "Early Relations of Man to Plants," Geographical Review, Vol. 37, (1947), p. 16.

10. Zimmermann, Erich. World Resources and Industries. 1951, p. 13.

11. Ibid., p. 83.

12. Marsh, G. P. Man and Nature, or Physical Geography as Modified by Human Action. New York, 1864.

13. Pinchot, G. Breaking New Ground. New York, 1947, pp. 319-326.

14. Shaler was a major figure in what we now recognize as the early days of American geography. His ideas on conservational management of earth resources are stated succinctly in Man and the Earth. New York, 1905. For Sauer's writings on this theme, see bibliographical notes on Chapter , Historical Geography.

15. Malin, J. C. "Space and History. Reflections on the closed-space doctrines of Turner and Mackinder and the challenge of those ideas by the Air Age," Agricultural History. Vol. 18, (1944), pp. 65-72, 107-125.

16. Russell, R. J. "The Desert-Rainfall Factor in Demudation," 16th International Geological Congress, 1933. Report. Vol. 2, Washington, D. C. 1935. pp. 753-753.

17. A Report on Japanese Natural Resources. Prepared by General Headquarters in Tokyo, 1949. One volume with map supplement. Noteworthy for its attention to costs is a somewhat similar study of United States resources: Dewhurst, J. F. and Associates, America's Needs and Resources. New York, 1947. Although credit is given geographers at various places in Dewhurst's study, it does not reflect geographic thinking to the extent of the volume on Japan.

18. Read at the annual meeting of the Association of American Geographers in April, 1950, at Clark University.

19. Whitaker, J. R. The Life and Death of the Land. Nashville, 1948, pp. 73-95.

20. A good example is Sauer, C. O. "Theme of Plant and Animal Destruction in Economic History," Journal of Farm Economics, Vol. 20 (1933), pp. 765-775.

21. Parkins, A. E. and Whitaker, J. R. (Ed.). Our Natural Resources and their Conservation. New York, 1936; Renner, G. T. Conservation of National Resources. New York, 1942; Smith, G-H. (Ed.) Conservation of Natural Resources. New York, 1950; Whitaker, J. R. and Ackerman, E. A. American Resources. New York, 1951.

22. Gottman, J. "Vauban and Modern Geography," Geographical Review, Vol. 24, (1944), p. 128.

23. Ibid. p. 128.

24. Report of the Mississippi Valley Committee of the Public Works Administration. Washington, D. C. 1934.

25. A Water Policy for the American People. Vol. 3, Washington, D. C. 1950.

26. Harrison, R. W. and Kollmorgen, W. M. "Drainage Reclamation in the Coastal Marshlands of the Mississippi River Delta," Louisiana Hist. Quarterly, Vol. 30, 1947, pp. 1-37.

27. Van Hise, C. R. The Conservation of Natural Resources in the United States, New York, 1910, p. v.

28. Fitch, Josnua G. Thomas and Mathew Arnold. New York, 1897, p. 66.

29. An excellent example is Florida. See the volume prepared under the direction of Henry Becker. Florida, Wealth or Waste. Florida State Department of Education, Tallahassee, 1946.

THE GEOGRAPHY OF AGRICULTURE

The volume of research studies concerned with agriculture is far larger than that in any other aspect of economic geography. Reasons for this concentration of effort are fairly obvious. Agriculture is unique among the major types of economic activity in its requirement for large amounts of earth space. Inevitably the attention of even the most casual traveler is directed toward agricultural land use. Since the workings of agriculture are readily observable, and since these activities depend heavily upon the availability of the stores and forces of nature, students of man and his environment are easily intrigued. Because agriculture is concerned with the supply of food and clothing materials, the economic and social interest in understanding its geograpic characteristics is both abundant and continuous. Finally, in most parts of the world, data for agricultural land use are more numerous and trustworthy than for any other type of economic activity. Here, therefore, the geographer has found ample motivation, excellent opportunities for observation, and a relative abundance of data. Little wonder that agriculture has received major attention in his research activities /30/.

Scope

The majority of American geographers seems to favor the inclusion in this field of all types of land-using activities that are not extractive in character. Agriculture is commonly defined to include not only the production of crops, but also animals, and in some cases, continuous-yield forestry and fur farming. It does not, on the other hand, include mining, or other economic activities not concerned with repetitious production from the same sets of resources in the same area. Neither does it include manufacturing or other economic activities that use land primarily as a place to erect structures in

which to carry on business rather than as a source for the production of commodities. Fishing is rarely considered as a form of agriculture, although many authors have pointed to the similarity between agriculture and those types of fishing in which ponds, lakes, and bays are systematically stocked with fish which are fed, slaughtered, and marketed in much the same manner as farm animals.

Approach.

As in other branches of geography, two approaches to the geography of agriculture have been used. One approach begins by selecting an area, observes the ways in which its lands are used for agricultural production, and (in most cases) proceeds to identify the processes which have resulted in the observed patterns of land and land use. The other begins with an aspect of agriculture, such as a crop or an animal product, or an agricultural system, plots on a map the areas it occupies, and (in most cases) undertakes to explain why those locational patterns exist. The similarity in these approaches is evident. In the former (land-utilization or regional) approach, several aspects of agriculture may come under observation at one time, but separate explanations for the location of each must be undertaken. In the latter (commodity or topical) approach, the work is restricted topically, but the same sort of analysis is indicated for the areas where the commodity is produced. Since topical studies are simpler than land-utilization studies, the possibility of extending them to large areas is much greater. Thus the study of the location of a single phase of agriculture in all parts of the world may lead to the formulation of generalizations for which the student of land utilization may find effective use in his analysis of the inter-relationships among various types of occupance in specific areas.

Procedures employed in the two approaches are nearly identical. Each

must identify, classify, and measure the phenomena under investigation and establish their locations before analysis of those locations may be undertaken. In general, the same analytical procedures are employed. Let us first focus attention on the characteristics and problems involved in those procedures.

Methodology

Identification and Classification

Since, by definition, agriculture includes a wide variety of activities, some system of identification and classification must be utilized if effective analysis is to be undertaken. Much controversy has accompanied efforts to devise a system that will be most useful for the purposes of geographic analysis. These controversies reflect differences in motivation and philosophy among geographers that are worthy of note. Generally, they reflect differences in the objectives of geographic investigation.

1. Most popular of the classificatory devices is the scheme based on commodities produced. These comprehend the commonly used categories such as wheat, corn, cattle, sheep, coffee, and the like. Commodities may be lumped into larger groupings, such as grain or livestock, or sub-divided as minutely as desired (durum wheat, beef cattle, merino sheep, etc.).

Commodity classifications have many advantages. They are easily defined, readily quantified, and in general use by other sciences concerned with agriculture. Strenuous objections appear, however, from those who point to the fact that farming is more than the mere production of commodities. Employment of the term "plantation" to designate a distinctive type of agricultural organization probably provides the best example of the adoption of a term designed to convey this organizational idea. Students of agriculture in the broader sense seek to develop a classification that would embrace both

commodity and non-commodity factors with the hope of finding a more accurate way of describing farming as a "way of life." Such a system of classification would also recognize the fact that in most societies the farm is simply a part of a complex division of labor, whose purpose is to provide food and raw materials, but whose operation includes many areally associated non-farm activities /31/. They also point to the obvious fact that almost never is a farm devoted to the production of a single commodity; rather it is an enterprise devoted to producing several inter-related commodities whose significance is difficult to comprehend if each of them is considered in isolation.

This last-named objection has been met to a considerable extent by devising "crop-and-livestock-combination" categories such as corn-hog, grazing-grain, and even more complicated compoundings of commodities. Introduction of these combinations has softened the criticims, but it has by no means silenced it, for it has not provided a complete indicator of different agricultural "ways of life."

2. To accomplish these objectives, several non-commodity elements have been proposed for inclusion that would "humanize" the commodity scheme of classification. (a) Most widely accepted of these appears to be the distinction between self-sufficiency and trade as the dominant purpose of farm activity. This classification, often labeled "subsistence" and "commercial," is commonly attached to a commodity grouping. (b) A second set of criteria is concerned with the intensiveness of the production process, usually measured as the amount of labor (or labor and capital) applied to a given unit of land area. The terms "extensive" and "intensive" have long been used by both economists and geographers to differentiate between the large land-using methods commonly used in frontier areas where land is cheap and the more

painstaking methods used on small plots where land is expensive /32/. Here the kinds of tools used and the degree of mechanization are often made important elements in the classification. (c) Types of management are frequently considered a significant aspect of farm life, especially where the units are owner-occupied, tenant-operated, pay wages in money or in kind, or employ a simple or elaborate division of labor /33/. (d) Many students would also like to include farm structures, their types, sizes, and arrangement, in an overall classification, since these have an important bearing on farm life. Whittlesey advocates inclusion of all of these elements, states that each of them can be measured, and therefore envisions a classification based on a weighted average of all of them /34/. So little of this information is available, however, that such a system could not at present be applied quantitatively to any significant part of the world's surface.

3. Non-economic criteria are often used in identifying and classifying types of agricultural occupance. In particular, these criteria may include family, tribal, community or other systems of organization for purposes of social control, as well as various aspects of settlement. For certain purposes the inclusion of such non-economic or quasi-economic criteria may produce categories that are more meaningful than those based on strictly economic consideration.

In addition to the stark reality of lack of data, there is danger in setting up any type of classificational device that incorporates a large number of variables. If class intervals used in measuring each variable are small enough to be meaningful, the number of categories is very likely to be so large as to become unmanageable; and if the class intervals are large, the preciseness of the classification is impaired. There is much to be said for

first analyzing one aspect of agriculture at a time, before one attempts to analyze several aspects simultaneously.

In any event, however, the past quarter-century has witnessed increased insistence that students of agricultural geography identify their phenomena carefully and intelligibly, so that their readers may have no difficulty differentiating one type from another. In particular, this trend has taken the form of greater insistence on quantitative measurement.

Quantification and Measurement

"Precise description is dependent upon measureable data; and without precise description accurate analysis is impossible." Few geographers have stated that portion of their creed so bluntly, but virtually all of them have felt obligated to utilize all available data concerning their topics of investigation. The demand for more and better data for agricultural geography has been continuous and virtually unanimous.

Despite the almost universal recognition of the need for quantification, there has been room for a very considerable amount of disagreement concerning the types of data that will best measure the phenomena under consideration. It will be recalled that, by common consent, these phenomena have been mainly related to production (rather than consumption or distribution) and that there has been a very general desire to include not only commodities but also means and facilities as part of the production picture. How shall these be measured? Three major criteria have been used, involving measurements of (1) area, (2) population characteristics, and (3) income.

Land Area

Land area units have been most commonly used to measure quantities of agricultural production. Absolute quantities may be expressed in number of

acres (or other areal units devoted to specific purposes in a particular area, but since relative measures are generally desired, ratios such as the percentage of land in farms, percentage of farm land in crops, percentage of crop land in a certain crop or crop combination, number of animals per square mile, or quantity of production per acre are commonly employed /35/. Population characteristics are also in common use to identify and measure production. These generally attempt to measure occupations of the people, either indirectly by relating production to population (yielding per capita outputs of various commodities), or directly by use of numbers (or ratios) of persons employed in various categories as reported by governmental or other agencies, or ascertained by field investigation. Income data have been more popular among agricultural economists than geographers, but appear to be gaining in favor. In using these data, relative or absolute importance is calculated in terms of gross product, measured in dollars or other monetary units. These computations may use a land-area unit, farm, or one of the civil statistical divisions (county, township, etc.) as areal units, and are usually presented as percentages of total production represented by various types.

Much has been written in criticism or justification of these various measures. In practice, the land-area unit has been justified most frequently because it is the only available unit in many parts of the world. Critics condemn it because it makes no allowance for variations in productivity from one piece of land to another. Occupational measures overcome this difficulty to some extent, but likewise obscure individual variations in productivity, traceable to differences in inherent ability, training, or the availability of machinery. Income measures, since they are expressed in monetary terms, provide the best opportunity for comparison and summation of production from a

variety of sources (such as crops, animals and personal services ; but since these data are not available in sufficient detail for most parts of the world, few studies for areas outside the United States have used them. /36/ In year-to-year comparisons, income data must also be adjusted for changes in price levels, and there is also the problem of selecting a suitable base period. Despite these difficulties, writers have shown a recent tendency to use both land-area and income measurements, either singly or in combination, where both types of data are available.

Selection of a unit of measurement is obviously dependent on the kind of problem being investigated. If, for example, the purpose is to provide a background for planning specific uses for various types of land, units of measurement are likely to be land-unit areas. These units are also useful in areas where land qualities are uniform and areal variations in productivity are of little consequence. If, on the other hand, the major interest is in how people make a living, or in per capita outputs or land uses, measurement may well be in terms of numbers of gainfully employed persons, or of the total numbers whose livelihood derives from specific ways of making a living. Studies whose results are intended for use in connection with welfare programs often use these types of data which are best calculated to measure the economic status of inhabitants of an area rather than the uses of land itself, or the volume of production. Investigators who use income data see virtue in computing the gross product of an area in order to determine the importance of various elements in its economy. Since gross income includes production attributable to land, labor, and capital, it frequently is defended as the best measure of total production (or any phase of total production) in an area. In any case, however, measurement criteria must be chosen in the light of the

objectives of the study, and there appears to be no single measure best suited to all possible objectives.

Arrangement and Presentation of Data

The product of these early phases of the investigation is an array of data depicting the importance of selected phases of agriculture within the area (or areas) chosen for investigation. These data are for specified areal statistical units (farms, acres, counties, etc.) and thus measure the importance and variance of those phenomena within the area. They constitute, therefore, the setting of the problem under investigation. To facilitate that investigation, geographers almost invariably arrange these facts in graphic form by plotting them on maps. Tabular arrangements of data are generally considered less useful for analytical purposes, partly because some of the data used in the analysis may be difficult to quantify, but mainly because the spatial significance of the data is lost if the figures are disassociated from the areas to which they refer.

Presentations of these materials appear in virtually all publications concerned with the results of studies in agricultural geography. In the more general types of studies of small areas, they usually are called land-use maps. More generalized studies of larger areas (nations, continents, world) on smaller scale maps generally identify their areas as agricultural regions /37/. Such areas represent the areal extent of the various types of phenomena as defined by the author. In most cases the areas thus depicted are shown as homogeneous in that they include all lands having more-than or less-than specified quantities, percentages, or intensities of the defined phenomena. Selection of the critical points for these differentiations is of necessity arbitrary, based on the judgment of the authors or a consensus among scholars

working with that type of subject matter. Normally the reasons for choosing these break-points are given in the text of the article. Several critics have pointed to the inadequacy of the homogeneous region, since it establishes only boundaries and does not locate areas of greater intensity that may lie within the region (or of lesser intensity outside it). Analysts are frequently as much interested in these core areas of maximum intensity as in boundaries that appear as just satisfying minimum requirements /38/.

Sharp disagreement has also appeared over the selection of minimum break-points used in delimiting the extent of land-use areas. Controversies may easily arise where one author, for example, feels that all areas should be included that have 40 per cent of their land in a particular crop while another believes the minimum figure should be 35 per cent. These differences in definition may produce regions having very different sizes and shapes and so may have led to significant variations in conclusions reached as a result of analyses based on them /39/.

A considerable group of agricultural geographers feels that the use of arbitrary ratios to delimit areas is not justified. To these students, lines marking 35 or 40 percent of land use are far less significant than the distance between those lines. They state that areas showing steep gradients from one type of land use to another are the "real" boundary areas, while those having low gradients are in fact areas of mixed occupance. Students following these principles obviously are apt to derive land-use areas that differ considerably in shape from those derived by other methods. The formulation of acceptable principles to guide the selection of these critical values whould be of great assistance to research students in agricultural geography.

Analysis

The map of agricultural areas, dated, documented, and annotated with respect to the criteria used in its compilation becomes the basis for geographic analysis. Either its author or others concerned with discovering the reasons for the areal differentiation of agriculture may set about to determine why that pattern rather than countless other patterns has come into existence.

In its simplest form geographic analysis consists of comparing this map with all other available maps to discover the extent to which similarities are observed. When such similarities are discovered they are listed for more detailed investigation in later stages of the analysis. When all such correlations have been noted and checked, the investigator is in position to report his conclusions to the effect that in the area under investigation a particular form of agricultural production is found to be associated with specified physical and social conditions.

A geographer's heaven, therefore, would seem to consist of an enormous collection of maps on which every conceivable type of data had been plotted. Such a collection of maps obviously does not exist nor is there great probability that it ever will be created. In its absence, the geographer is often compelled to construct maps showing the particular conditions relevant to his problem. He finds that for best results he must study the area in which he is interested in the field. At this point, time and money become important considerations. Is there any procedure, any short-cut method, that would enable the investigator to give priority to certain types of data in his analysis? What kinds of maps would be the first to be examined or compiled?

In almost all cases, students of agricultural geography have erected a hypothesis to perform this function. This hypothesis normally arises from self-interrogation; the investigator feels forced to ask himself, "What kinds of processes might normally be expected to exert an influence on the areal distribution of the phenomenon I am investigating?" In an earlier day, many geographers were convinced that the whole explanation could be found in examination of the various phases of the natural environment, and showed little inclination to include cultural elements in their hypothesis. More recently a wide variety of cultural features has been included. The basis for choosing among these factors often lies in the findings of one or more of the systematic sciences, such as botany or economics. These studies often point up the general significance of various physical and cultural elements, such as, for example the effect of rainfall, soils, and temperatures on yields of a particular crop as discovered by the botanist or agronomist, or the effect of wage rates and transport costs on profits, as discovered by the economist. From these findings the investigator may often arrive at a conception of what might normally be the most critical elements influencing success or failure of the agricultural activity he is investigating. Naturally, he would be led to examine maps showing the distribution of these elements early in his study. Ideally, he must examine maps of all possible factors; in practice, because of lack of data, he must often be content with an examination of far fewer elements then he would like to employ.

There is, however, much to be said for the investigation which deliberately confines itself to the exhaustive consideration of just one element for which adequate data may be obtained. Studies of the spatial relationships between one or two climatic features, such as rainfall or temperature, and the

yields of particular crops have added much to the knowledge of agricultural geography /40/. Even though these studies fall far short of a complete explanation of the conditions under which those crops are successful, they constitute the beginnings of such explanations, and show what may be achieved after similar studies dealing with other factors have been added to the literature. In other words, they provide the materials from which more useful hypotheses may be constructed for use in future studies. This is the toilsome process by which geography acquires the means for understanding the agricultural occupance of particular areas.

There remains the technical problem of determining the actual presence of a factor in the area under analysis. Practically, this is a process of correlation, in which the analyst observes similarity of pattern between the distribution of his mapped data and that of each factor with which he is comparing it. In nearly all cases, these correlations have been made visually, by comparing maps or plotting both sets of data on the same map. Where similarities of patterns are observed they are noted. A few authors, however, noting the possibility of differences of opinion concerning these visual correlations, have pointed to the desirability of substituting measurement for judgment. Statistical devices for measuring the degree of correlation may be used where both sets of data are completely quantified (as in rainfall and crop yields), but where one factor (such as soil quality) has not been quantified, reliance must be placed on graphic analysis. It appears that geometric procedures for measuring these types of correlations may easily be devised.

In any event, the ultimate product of research in the topical phases of agricultural geography is a set of generalizations establishing the

circumstances and conditions under which various types of agriculture come to occupy portions on the earth's surface. These generalizations in turn become the analytical tools used in arriving at an understanding of the manner in which the agricultural lands of specific segments of the earth's surface are used.

LAND UTILIZATION STUDIES

Although land utilization studies may be concerned with any aspect of economic geography or with studies of settlement geography, nearly all of those produced by American geographers have been primarily agricultural in character and are thus logically considered in conjunction with agricultural geography.

The motivation for studies of agricultural land use has generally been entirely practical. Various organizations, both governmental and private, have been confronted with the need for changing the character of the agricultural occupance of specific areas under their control and have enlisted the aid of trained geographers in formulating plans to bring about this transformation. Goals of the program are established by the agency. Work of the geographer consists essentially of determining how to use available resources of an area in such ways as to attain those goals most efficiently. In carrying out such an assignment he prepares maps showing past and present land used, prepares inventories of soil qualities and other resources, and attempts to determine the locations in which changes in occupance may be made most effectively.

If agricultural geography were a completely developed science, land-utilization studies might well be considered as an applied phase of the subject. Under those circumstances, the work of the geographer would consist mainly of taking an inventory of the agricultural resources and applying existing

generalizations from topical agricultural geography to determine how various lands within the area might best be used to achieve the desired changes in production. With his new land-use map as a basis, he could then proceed to determine the need for and location of other aspects of the economy such as transport facilities, town and village activities, and the like, all of which would be related to the newly-revised functions of the agricultural economy as well as physical conditions in the area.

Unfortunately, as we have seen, agricultural geographers have not yet been able to provide a large number of laws and principles for application to specific areas, although their equipment for this task has been better than could be found in any other discipline. Here is simply another case in which demand for the application of theory has outrun the development of the theory. The result would have been easy to predict. Land-utilization investigators were encouraged to develop systems of identification, classification, measurement, and analysis in order to proceed satisfactorily with their work. These innovations have in turn been incorporated to a considerable extent into topical agricultural geography and have contributed much to the development of the field.

Land Inventories and Their Uses

The major contribution from these studies appears to have been in the realm of identification and measurement. The preparation and publication of land-use maps has been a continuing interest of economic geographers for several decades /41/. These maps provide excellent starting points for analysis, and in many cases their authors have engaged in a certain amount of analytical work in conjunction with their preparation. Most of these maps present data compiled by field investigation and their coverage was of

necessity limited to small areas. Land-utilization studies of larger areas have appeared only where government sponsorship has made public funds available for their prosecution. One of the earliest and most useful inventory system was the one devised in connection with the Michigan Land Economic Survey /42/. Geographers who served as consultants in the early days of the Tennessee Valley Authority were responsible for several innovations in the identification and classification of agricultural lands and uses. In contrast to most of the earlier investigations, work in the TVA region involved relatively large areas so that detailed field investigation was not possible and a system of area sampling had to be devised to accomplish the desired result /43/. Both the classificational system, which incorporated both physical features and land uses, and the sampling procedures have been of much value in later studies. Refinements of these techniques were incorporated into the more recent land-use studies in Puerto Rico.

The usual classification system developed for land-use inventory work involves measurement of a variety of physical and cultural features. These features, selected from past experience with agricultural problems, usually include degree of slope, soil types, drainage conditions, and climatic elements, as well as the type of agricultural or other land use found on specific plots of land. For convenience in handling, these data are often expresed in compact form. The immediate result is an array of data that is easily manipulated to show correlations among the several elements, either statistically or graphically. Generalizations thus computed could then be applied to individual parcels of land to determine their suitability to the other

types of land uses envisioned in the program, and based on experience in the area itself. These generalizations, in turn, have provided valuable additions to the literature of topical agricultural geography.

The scientific value of results obtained from land-use studies must be judged primarily in terms of their applicability to other areas. This applicability can be achieved only after a large number of studies, using comparable techniques and classifications, have been completed. When one recognizes the fact that only a minute fraction of the earth's surface has been mapped in this way and that there has been considerable lack of agreement as to techniques and methods among investigators who conducted the surveys, the outlook for accumulating a set of principles that would be generally applicable seems very dim. On the other hand, the prospect for obtaining financial assistance for this type of work is considerably brighter than for topical studies, and there can be no doubt of the general usefulness of the result if enough areas can be investigated in a uniform manner. As in other fields of human knowledge, greatest advances are likely to be made where popular demand for applied research is greatest. As in regional geography, land-use studies have a great advantage over topical studies in their ability to keep all aspects of human existence in an area constantly before the investigator. As reconnaissance studies, they have done much to call attention to previously overlooked factors in topical geography. And as data-gathering devices, their usefulness has been unsurpassed. They have contributed materially to the knowledge of agricultural geography.

30. The number of studies is so great that no attempt has been made to list or even evaluate them. Publications cited are regarded as representative publications in the field.

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GEOGRAPHY OF MINERAL PRODUCTION

Minerals are of tremendous and increasing importance in the world of today. At the same time, mineral resources are strikingly uneven in distribution over the earth's surface and, unlike other resources, are exhaustible and nonrenewable. It follows, since mineral deposits are exhaustible, that the mineral production pattern is inherently a shifting one. Such facts as these make mineral production a challenging and attractive field for investigation.

Geography of Mineral Production as a Distinct Field

In this important area of interest several disciplines are concerned. Here the economic geographer must the geologist, the mineral economist, and the mining engineer. Each makes his own distinctive contribution. The geographer concentrating on the minerals field is not, like the economic geologist, primarily interested in the origin of mineral deposits. Neither is his chief interest in methods of production, as is the mining engineer's, nor in the collection and analysis of mineral statistics, which is the business of the mineral economist. Instead, he focuses on the spatial distributional patterns and associations of mineral production. He is responsible, more than are these others, for the examination of mineral production as a part of the total economic complex of particular regions.

Other branches of economic geography deal to some degree with minerals, but in none of the others are mineral production patterns the center of interest. Mineral production is a form of land utilization, but the area it occupies is so limited that it generally is accorded little attention in land utilization surveys. The student of resources is concerned with

minerals, but he is more likely to think of them in a broad resource program than to study individual mineral producing regions or the patterns of mineral production. Moreover, the geography of mineral production grades into the geography of manufacturing, since most of the world's minerals are produced as raw materials for the factory and the location of mineral production is an important factor in industrial localization. Thus the geography of mineral production has a number of near relatives yet has its own distinctive core.

Central Theme of Mineral Geography

Like all other geographers the economic geographer working in the field of mineral production is concerned with the combinations of phenomena that characterize places. Though he deals primarily with a mineral product or with the activity of mining, the product or activity is always in a regional setting, even though the region may be only a locality or may be the entire world. Through study of the distribution patterns associated with mining in relation to other relevant areal distributions within his chosen areal unit he attempts to gain an understanding of the mineral production patterns. He is concerned not only with the mining phenomena but also with the geological pattern, with the flow of mineral products to the factory or other consumer, with the concentrations of people who depend directly or indirectly upon mineral production for a living, with political patterns that affect the mineral production patterns, and with various other spatial distributions that help to explain the mineral production upon which he focuses.

It needs hardly to be added that the mineral geographer's interests are by no means confined to the spatial distributions of the present. Mineral production patterns have changed with time and so, too, have the areal

distributions relevant to mining. The pattern of a mining region today is fully understandable only when the study is grounded upon a knowledge of the changes of the past.

Description and Interpretation

The study of spatial distributions associated with mineral production in relation to other relevant areal patterns involves, as does all geographic work, description and interpretation. A fundamental part of the description takes the form of the construction of maps of mineral production. Here there is a marked analogy to manufacturing: in both mining and manufacturing a great deal of wealth comes from very small areas. This gives rise to special cartographic and mapping problems. It is difficult, for example, adequately to represent either mineral production or manufacturing on the maps of a general land use survey, since these activities are likely to have an economic importance out of all proportion to the surface area they occupy. Obviously, any symbol used must be on a very different scale from that used to represent agriculture.

In a sense, scale functions too when it comes to interpretation. It is relatively easy to gain an understanding of the details of local patterns of production since they reflect such simple factors as relative accessibility of minerals and methods used for their recovery. The arrangement of iron mines on the Mesabi Range of Minnesota exhibits a linear pattern because the mines are localized by a belt of iron-bearing rock, and the oil wells in northern Pennsylvania show a checkerboard pattern of local distribution that is attributable directly to the "five-spot" system of secondary oil recovery.

Similar factors are important, too, in explaining some of the broader mineral production patterns that may be seen on maps covering larger areas on smaller scales. Thus the belt of coal mining in the Appalachian Plateau reflects the trend of a broad geosyncline with its rich coal seans, and the distribution of coal production throughout the United States and throughout the world reflects to a considerable degree the occurrence of rocks of certain favorable ages.

But unfortunately such simple and obvious explanations are only partial truths. Of course the mineral values have to be present or there can be no mineral production but that still leaves questions of time and place. Why were some mineral deposits which are now of tremendous importance neglected until a few years ago? Why does the mineral production map fail to reflect the real distribution of mineral resources for large sections of the earth's surface.

Obviously, no simple answer will suffice. The whole problem is tied up with the rapid increase in industrialization. The use of minerals has been pyramiding as evidenced by a recent statement that "The quantity of mineral products consumed between 1900 and 1949 far exceeds that of the whole preceding period of man's existence on earth" /44/. With this demand have come technological developments that have been constantly changing the patterns of mineral production. Deposits formerly considered valueless have become workable through the use of new techniques of ore treatment. Minerals unused a decade ago are suddenly so much in demand in industrial processes that they are listed as "critical." And new prospecting devices and techniques, such as the airborne magnetometer and the Geiger counter, are bringing real efficiency into the search for minerals. The mineral geographer,

if he is to understand the broad aspects of the mineral production pattern, should be aware of the rapidity with which the minerals picture is changing, and he must interpret what he studies in terms of our current stage in this era of rapid development.

With the vast increase in production and use of minerals has come a change in financing. Capital requirements for mineral production have become so great that small deposits are of interest only in the case of particularly rare commodities. Moreover, minerals remain unused in countries which lack adequate capital for exploration and development and yet put up barriers against the inflow of such capital. Fisher has pointed out that "An atlas of maps showing the distribution of capital, by country of origin, and area of investment, for decennial intervals during the past hundred years" would be of tremendous value in making contemporary economic geography intelligible /45/. There is no phase of economic geography in which such maps would be more useful than the interpretation of the world's mineral production patterns.

To understand areal contrasts over the earth's surface the mineral geographer need to go much further. He must takeaccount of the great contrasts in the world's economies which go far to explain why the mineral deposits of some areas are undeveloped and of others largely unknown. He should not lose sight, either, of the great differences between production under communism and in our capitalistic society. Under the former, state need and supply of labor are the determining factors in deciding whether an operation should be carried on. Under capitalism, production costs normally must be sufficiently beneath market price so that a profit results. If,

under capitalism, increased demand for a mineral commodity or a decline in supply results in a price increase, it becomes profitable to work lower grade deposits of the mineral and to obtain more readily capital for investment in exploratory activities, which ultimately lead to increasing available reserves. The geographer should take cognizance, too, of the growing tide of nationalism that is making it increasingly difficult to carry on the world-wide operations that have characterized capitalistic economy in the past. Still another complicating factor is the effect of war and war preparations, which focus demand upon "strategic and critical minerals."

Such broad aspects of the minerals field must be taken into account by the geographer if he is to understand why mineral production is carried on where it is. Nevertheless, they should be regarded chiefly as background for his work and not unique to geography. Let us return to the more immediate and specific efforts of the mineral production geographer.

Sources That Supplement Field Work

The mineral geographer supplements his field work with whatever published and unpublished materials may be available. Published reports and technical magazines are vital to his work, and statistical data play a prominent role in his investigations.

On a world scale, production data are reasonably adequate. They are available in summary form in the Minerals Yearbook of the United States Bureau of Mines, the chief official collector of mineral production data in this country, and in various world statistical volumes. As with other statistics, mineral data are lacking for some countries because of inadequate machinery for collection and for others because of deliberate withholding

of such information.

Statistics of mineral production within the United States are published in the Minerals Yearbook. For a number of mineral products, only state totals are released. Certain types of mineral production are more widespread, however, and for these, better localizing data are given. Petroleum production figures are published by leading fields within states, iron ore production totals are given for the larger mines, and the production of copper, lead, and zinc is localized by districts within states. For coal production, chiefly because of its wide areal spread, production is given by counties.

For the geographer interested in local mineral production studies there are other sources of data. For example, a number of states have state bureaus of mines which publish figures on tonnages and employment, and valuable data are also published by such trade associations as the American Petroleum Institute, the American Gas Association, the Iron and Steel Institute, and the Bituminous Coal Association. These sometimes are useful in supplementing federal data, thus serving better to localize the mining function.

From the geographer's viewpoint mineral distribution data are particularly important. Distribution data are available for anthracite on an annual basis, and for crude petroleum and refined petroleum products distribution data are reasonably complete. The United States Bureau of Mines formerly published from time to time detailed bituminous coal distribution statistics covering movements within the United States, but because of lack of authorization and curtailment of funds such data have not been collected since 1946. Some information of this sort can still be gleaned from the Interstate Commerce Commission reports, and the Economic Commission for Europe does a reasonably good job on distribution statistics from coal fields to consuming

nations for Europe. It would be extremely useful to geographers, however, to have comprehensive international and intranational distribution data for all of the mineral products.

Contributions of American Geographers

The geography of mineral production has attracted only a few American geographers. Not more than ten articles in this field have appeared in the Geographical Review during the magazine's existence, and fewer than this in the Annals of the Association of American Geographers. The number has been somewhat greater in Economic Geography, as might be expected from the specialization of the magazine, but the attention paid to mining in the geographic literature in general has been vastly less than that accorded agriculture.

Why has the geography of mineral production attracted relatively few investigators? There is the very obvious answer that agriculture is so much more widespread and that even where mining is important it has little surface expression in proportion to the value of production. Doubtless, too, many have felt that they lacked the technical background which studies of mineral production geography seemed to involve. The inattention to this phase of geography may have been due in part to something else: to a disposition on the part of American geographers to leave the problems of mineral production to the geologist.

This last tendency may explain why geographers were for years overshadowed in their contributions in this area of research by economic geologists with mineral economic leanings. The books of C. K. Leith, for example, have been outstanding in this field /46/. Geology and geography were long associated at the University of Wisconsin, as they have been at so many universities,

and Leith, who was chairman of the combined departments, undoubtedly was influenced by his geographic colleagues. Nevertheless, he was a geologist. So too, was H. Foster Bain, the author of a particularly challenging article that appeared in th 1920's /47/. These contributions and several others of the same type /48/ may lack something when measured by the geographer's yardstick, but they show a breadth which mineral geographers are still short of attaining.

The work of geographers, on the other hand, has been sporadic, touching here and there on various phases of the minerals problem. A few illustrations will serve to indicate the directions this work has taken.

The commodity (or commodity-in-area) approach appears to have been the most common and yet to have yielded few noteworthy products. In this group are studies of the aluminum industry, of coal mining, of copper production, of the production of natural gas, and of various other commodities /49/. In these commodity studies the area covered ranges from the mining district or the oil camp to the continent or even the entire world. Sometimes the resource rather than the industry has received the emphasis /50/; in a few instances transportation of the product has been the major focus /51/; and Miller has used the commodity approach in a statistical study comparing the mineral production of nations /52/.

For the most part the studies of this commodity group are informational and do not represent anything new in method or any real specialization, but there are exceptions. One of these is Frey's work on petroleum /53/, a subject on which he has become a recognized authority. Walter H. Voskuil's work is another exception, since its author has dealt consistently with mineral production problems for a number of years /54/.

"World Geography of Petroleum," issued by the American Geographical

Society in 1950, might be thought of as falling within this commodity group. In spite of the unquestioned value of this book, however, it can hardly be classed as geography except in a popular sense of the term, since it is largely a collection of geological essays on petroleum in various parts of the world.

Studies of mineral producing regions have been almost as common as commodity articles. Here, again, the emphasis has varied greatly from one writer to the next, just as the areal unit discussed has varied. For the most part the products are regional studies with emphasis upon the mineral factor /55/. Other writers, though perhaps not notably different in their final products, stress patterns of occupance in the region /56/. The sequent occupance approach has been used by some /57/. And there are a number of other studies in which one device or another is used to present regions dominated to a notable degree by mining. Oddly enough there seems to be no case in which mining as an occupation forms the central theme.

Not infrequently problems of mineral conservation have been brought into the commodity and regional studies, and the several books in the general field of conservation have sections dealing with mineral problems. But aside from some work by Miller on the problems of conservation associated with coal stripping /58/ no geographer appears to have concentrated on this aspect of the minerals field. Again it may have been felt that such problems were being dealt with adequately by the economic geologist.

Both within individual regions and for larger areas the patterns of mineral production are constantly changing. Recognition and measurement of shifts are well within the province of the geographer. Murphy and Spittal have made a start on the measurement of such changes through an adaptation of the centrographic method to shifts in coal production /59/, and an economic geographer

employed by the United States Bureau of Mines has used the same technique in studying the effect of movements of the world center of petroleum production on pricing systems /60/.

There are, of course, too many studies for all of them to be cited here, but the foregoing indicate some of the major pathways that have been followed.

Frontiers of Investigation

Much work remains to be done in mineral production geography. The topics summarized in the following pages are only a few of the possibilities. It seems worth while, however, to list some of the many potential lines of investigation in the hope that these suggestions may stimulate more studies in the field of mineral geography.

Studies of Individual Mineral Industries

If mineral geography is to play a larger role outside the classroom mineral geographers must specialize, and one possible line of specialization is on individual mineral industries. For example, the coal industry of the United States should be re-evaluated. There has been a great deal of technological research done on coal in recent years. Is the geographic pattern of the industry being fundamentally changed thereby? The constantly-changing picture of coal production within the United States and the movement of this coal to its markets should furnith material for a number of worthwhile studies. It is to be hoped that in the future some geographers will have so far distinguished themselves in this field that their services will be considered indispensable when national planning involving coal is contemplated.

The development and shifts of a number of other mineral industries, also might well be studied. Iron ore, petroleum production, the copper industry,

the zinc industry, and various others should be studied from the standpoint of their evolution, how they have moved and are moving, and how they are likely to move in the future. A single industry, or even certain aspects of a single industry, could well form the subject for a lifetime's research. Obviously, there is no necessity for confining such studies to the United States, but just as obviously there is much work of this sort that could be done within the country's borders.

Studies of Mining Regions

More studies should be made, too, of individual mining regions of all sizes. The study of mining regions reveals the interplay of the mining process with other elements of the local setting, the people who work in the mines, the houses they live in, the transportation pattern, the other industries that are present, and the many other items that go to make up the unique character of the region. The historical factor is essential in giving depth to such work. There are many regions that might well be studied. The Tri-State Zinc District, the Iron Ranges of Minnesota, a copper mining center of the Southwest, or any one of hundreds of mining districts and communities might well form the subject for investigation. A number of such studies have been carried out, but little more than a good start has been made.

Ideally, studies of individual mining regions should go hand in hand with studies of the mineral industries. The two approaches are appropriately correlated, since anyone studying the zinc industry, for example, could gain much by studies of individual zinc mining regions.

Sequent Occupance Studies

Mining regions pass through age sequences just as other types of areas

do. New areas of mineral production have characteristic features and problems; so do mature and old regions. Studies of the characteristics of mining regions of different ages are well worth while. Age studies have been carried on from the geological point of view /61/, and as earlier pointed out, geographers have studied sequent occupance in several mining areas, but more studies of this sort are needed. Aside from knowledge for its own sake they might yield much that would be useful in planning. Possibly some of the problems that plague mining regions in their last stages of existence might be avoided if we knew more about the whole aging process. In any case the study of sequent occupance of mining regions has merit as subject for investigation.

Social Problems of Mining Regions

Various social problems that accompany mining need to be studied. Why, for example, is an area of unusual mineral wealth so often a marginal one in terms of economic well-being? The Welsh coal fields and our own Appalachian coal fields were real problem areas during the depression years of the early 1930's, and, even in more prosperous times, the natural wealth of such areas does not find adequate reflection in the lives of their citizens.

How can the real importance of mining in the economy of an area be studied? Employment in mining obviously is not enough to measure the significance of the industry, since transportation workers, merchants, and various other who are not directly employed in mining are nevertheless largely supported by the mining activity. What has been the real significance of the copper industry to Arizona or of the oil industry to Oklahoma? Perhaps some investigator will be able to set up criteria that will measure this real importance.

Related to this problem is the attempt to measure the value of an imported mineral product to the nation in which it originates. Take the example of copper mined in Chile and imported into the United States. It would indeed be interesting if we could develop some means of comparing the returns to the originating country in terms of taxes, wages, etc., with the returns to the consuming country.

Mineral Production Regions

Even the depicting of the world's mineral production presents its problems. Thus far no one has recognized types of mining regions for individual countries or for the world at all comparable to those evolved for agriculture. The development of such a system presents serious difficulties. Mining is limited to points on a map, though the importance of these points may be out of all proportion to areal extent. Other difficulties are the seeming heterogeneity of the picture, one mining area often producing a variety of minerals, and the great variation in richness of deposits within short distances. Nevertheless, a better job of regionalization than has been done thus far should be possible and is distinctly within the realm of the geographer.

Minerals in World Affairs

Minerals are an extremely important factor in world affairs. No modern nation can hope to be really great without controlling a supply of the more essential minerals. But here again the picture is by no means static. The discovery of new mineral sources and the decline of old ones requires periodic re-evaluation of the mineral position of the nations. Possible effects on mineral production of the rising tide of nationalism; tariffs in relation to minerals; taxation of mineral deposits; the place of mineral production in the

"Point 4" program; the desirability of stockpiling critical minerals, all are examples of problems on which the point of view of the geographer should be of value.

A Specialized Background Needed

It was pointed out in an earlier section that a knowledge of economics should be part of the equipment of every economic geographer. But for the economic geographer who specializes in mineral production geography more is needed. For serious work in this specialty a background in geology and mineralogy are further requirements. It is the economic geographer with a background in economics, geology, and mineralogy who is likely to make substantial contributions in this field, particularly if he knows something of mineral production methods or is willing to persist in his topical specialty long enough to build up such a knowledge.

Scientific and Practical Aims

The initial motive of the geographer in undertaking such studies as have been outlined and others in the field of mineral production geography is a purely scientific one. Here is a phase of geography, and hence of knowledge, that has been neglected. Let us remedy the deficiency, says the geographer. By specialization in the coal industry, for example, the geographer, through the distinctive methods of his discipline, can bring to others a better understanding of the industry than has previously been available. Moreover, the contribution is a cumulative one. What he does will form a foundation for other studies in the geography of coal mining. Thus he is working to advance both knowledge and human well being.

On the more practical side the work of the mineral geographer may prove

of dollar and cents value even though it was undertaken with no such end in view. Moreover through his efforts he and his students may be called upon to serve industry directly, or to serve the government when problems regarding the mineral industries arise.

Conclusions

Minerals are a vital part of the world's economy and their importance is growing. Certain characteristics of minerals, unevenness of distribution, and the fundamental impermanence of the mineral production picture, give uniqueness to the geography of mineral production. Changes are numerous and rapid, depending upon exploration, technological developments, and various other factors.

Geographers have made a substantial start in the field of mineral production geography but only a start. Along with a growing literature a few geographers already have become recognized for their specialization in this branch of economic geography. It is a reasonable hope that more will concentrate in the minerals field, and that the geography of mineral production may become widely recognized for the importance of its contribution to knowledge.

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MANUFACTURING

Manufacturing occupies very little space on the earth's surface but is vitally important to man's livelihood, security, and progress. In the sharpness of localization patterns and in the areal and functional inter-relationships with other phenomena, manufacturing exhibits high geographic quality. Manufacturing often is associated with high density of population, high standards of living, advanced economic development, machine technology, an interdependent economy, well-developed utilization of resources, abundant transportation facilities, large urban markets, and political and military power.

It is not surprising, therefore, that interest in the geography of manufacturing in the United States dates back to the foundation of the republic. Alexander Hamilton proposed to Congress the establishment of a federal city of manufacturing because of the power of manufacturing to promote the general welfare; the city was to be Paterson, New Jersey. In 1853 the very first volume of the new Bulletin of the American Geographical and Statistical Society contained an informative account of cotton manufacturing in the leading countries of the world written by a New York merchant /1/. Not until the quarter-century 1903-1927, however, did professionally trained geographers begin to develop an interest in manufacturing and to consider the problem of how the phenomenon of manufacturing should be treated geographically. The best studies of this period were concerned particularly with factors in the location of manufacturing in a specific area.

In 1937 appeared three major papers, which marked the beginning of present methods of work in manufacturing geography /2/. Sten De Geer described quantitatively and cartographically the areal extent of the American Manufacturing belt; Richard Hartshorne attempted a general quantitative location theory

for manufacturing; and Robert S. Platt formulated a geographic classification of industries based on location types. As indicated by an inventory compiled by John Alexander the quarter-century since 1927 has been characterized by a regular flow of manufacturing studies in the four leading current American geographical periodicals /3/. There has been little consideration, however, of the nature and potentialities of the field of manufacturing geography as such /4/. As yet no American book has appeared devoted solely to the geography of manufacturing but one is in preparation /5/. In recent years courses in the geography of manufacturing have appeared in a score or more universities.

It may be well to state that the following account is concerned primarily with the contributions of American geographers to the geography of manufacturing. Contributions by economists, planners, engineers, and practical business men are of equal or greater importance but are mentioned here only insofar as they are closely related to work by geographers. Geographers are interested in where manufacturing is located; how such localizations are measured; why manufacturing is located where it is; in the various branches of manufacturing and their patterns and their relationships to raw materials, power, markets, labor, transportation, etc.; in industrial areas; in relations of industries to the areas in which located; in explanation of industrialization and in prediction of potential industrialization; and in practical application of manufacturing studies. Work in geography of manufacturing will be summarized here under the headings of distribution of manufacturing, statistical materials, location theory and location types, studies of individual industries, studies of industrial areas, explanation and prediction of industrialization, and problems needing study.

DISTRIBUTION OF MANUFACTURING AS A WHOLE

There are two problems pertinent to a study of the distribution of manufacturing. The first is to devise some statistical or cartographic method of measuring and recording the distribution of manufacturing. The second is to measure and appraise the changes which have occurred and which are occurring in this distribution.

Mapping the areal distribution of Manufacturing

The pioneer work in the quantitative delimitation of the areal distribution of American manufacturing was done by the Swedish geographer Sten De Geer, who lectured at the University of Chicago in 1922. His paper on the American manufacturing belt, published in 1927, was based on the number of wage earners in towns of more than 10,000 population /6/. An industrial city by his definition was one with at least 1,000 wage earners in manufacturing. For his areal delimitation he chose cities rather than counties, though figures were available for both. His map was a landmark. Indeed to this day it is virtually the only reasoned attempt to examine the possible factors in the localization of the manufacturing belt; especially valuable was his emphasis on the importance of the railroad and canal nets. Two aspects of his study have received further attention. 1) Manufacturing though primarily an urban function, extends also to suburbs, to independent cities of less than 10,000 population, and to certain rural areas, all of which were ignored on his map, except in Canada, where he utilized data for smaller cities. 2) The map tended in part to reflect the general distribution of population, since his wage earners included many engaged in purely local service industries; thus any large city would have enough workers in service industries to be considered an industrial city.

Richard Hartshorne attacked the second of these aspects /7/. He estimated that 10 per cent of the total population in any city might be employed in manufacturing to supply essentially local needs (i.e. employed in ubiquitous industries). Therefore, in order to ascertain employment in non-local industries, he subtracted from the total number of wage earners in each city a figure equal to 10 per cent of the population. He then took a figure of 500 workers in non-local industries as his minimum figure for an industrial city important enough to be depicted on his map.

Helen M. Strong made a comprehensive map of the distribution of manufacturing. By using county figures she included much territory omitted by De Geer and Hartshorne /8/. She contended that Hartshorne's picture of localized manufacturing overemphasized the concentration. Her interest like that of De Geer was in the inclusion of all manufacturing, particularly manufacturing of agricultural products. Density of manufacturing in 1929 was mapped on the basis of power per unit area (horse power of prime movers and electric motors per county). She also utilized a dot map of number of persons engaged in manufacturing in 1930 to produce her map of manufacturing regions, which covered a large part of the country.

Alfred J. Wright critically evaluated the various criteria of manufacturing and proposed that value added by manufacture be utilized as the criterion for the distribution and relative importance of manufacturing areas /9/. He contended that labor is but one factor in production, and one of declining importance at that, and that power and capital should be considered as well. The value added by manufacture is an effective summation of the total effort put into the manufacturing activity. He plotted his manufacturing districts on this basis. Like De Geer he used towns of 10,000

or more population, but by the inclusion of major manufacturing districts listed in the Census of Manufacturing he covered the suburban areas of the major metropolitan districts. Like Strong and De Geer, he asserted that all manufacturing industries should be included.

Clarence F. Jones noted that the limiting of data to towns of more than 10,000 eliminated a significant segment of manufacturing, more than one-half in South Carolina, and two-fifths in Texas. He therefore proposed that the county should be used as the basic areal unit, thus including all manufacturing in an areal as well as in a functional sense /10/. He then plotted separately the number of persons engaged in manufacturing, the power used in manufacturing, and the value added by manufacture and on the combined basis constructed a generalized map of areal distribution of manufacturing including each county with more than 4,000 wage earners, or 4,000 horse-power, or more than $4,000,000 value added.

The above maps with the exception of Hartshorne attempted to show the areal distribution of all manufacturing. Another valuable point of view is that of mapping the distribution of areas in which manufacturing is the dominant activity. Thus a commercial center of 100,000 would have more total manufacturing activity than an industrial city of 10,000 but obviously this manufacturing would not be relatively as important in the life of the city and would be of quite different type, being possibly largely for the local market only. Harris classified industrial cities on the basis of the employment in manufacturing in relation to employment in retail and wholesale trade /11/. This map, confined to cities of more than 10,000 population indicates the area in which the urban economy is dominated by manufacturing. McCarty noted that in the Manufacturing Belt, farms exist to serve their near-by cities

whereas in other regions, cities exist to serve their near-by farms. In an attempt to define the limit of the manufacturing belt under this concept he mapped counties having more factory workers than farmers, counties with per capita or per county manufacturing greater than the national average, and counties in which the ratio of manufacturing to wholesale trade exceeded the national average /12/.

Just as the first quantitative delimitation of the Manufacturing Belt of the United States was made by a European geographer (De Geer), so the first detailed quantitative delimitation of the manufacturing Belt of Europe was made by the American geographers Harris and Adkinson. This map (Fig. 1) shows the percentage of the gainfully occupied persons engaged in industry. It thus is really a map of areas in which manufacturing and mining dominate the economy. It is based on data by minor civil divisions in each country. Because of the enormous variation from country to country in statistical detail available, the map obviously is not uniformly reliable. Being based on labor it overemphasized textile and handicraft districts, which use female labor abundantly, and under-emphasizes heavy industry with large capital requirements. Unlike the maps of the United States it is based on occupation data from census of population rather than employment data from censuses of manufacturing. A similar map for Japan has been compiled by Thomas R. Smith.

Changes in Distribution of Manufacturing

One of the most interesting facets of the patterns of distribution of manufacturing activities is the dynamic character of these patterns. Sten De Geer assumed that the Manufacturing Belt was expanding to the west. The Rock River manufacturing area, the western margin, however, is an old industrial area and Iowa's proportion of wage earners in manufacturing in

the United States has remained relatively constant since 1904 /13/. But between 1939 and 1947 employment in manufacturing in the ten Missouri Basin states increased at a higher rate than for the country as a whole /14/. There has been a westward shift in the center of gravity within the Manufacturing Belt, in part as a result of the rapid rise of the giant automobile industry in the Middlewest.

Other studies have included analyses of movements from central parts of cities to suburbs or to nearby points but within the same industrial area, of sectional shifts from one industrial area to another, or of shifts from industrial areas to non-industrial areas as from the Manufacturing Belt to the South or the West. H. H. McCarty studied migrations for the period 1914-1937 and discovered that the industries which showed greatest relative shifts between states were industries which tended to be either raw-material-oriented or market-oriented /15/. His statistical analyses failed to confine any general flight of industry from the larger cities to rural areas. Indeed both McLaughlin and Cunningham have noted that wartime plant location was concentrated on metropolitan districts, which alone could provide quickly the large reserves of labor needed for huge plants /16/. Alfred J. Wright measured and described the shifts in the relative importance of the major sections of the United States in manufacturing 1919-1939 according to several criteria and during the war period 1939-1945 as measured by increased facilities /17/. A recent article by John W. Alexander analyzed the remarkable industrial expansion of 1939-1947 /18/.

Geographers have utilized also quantitative studies of shifts in location of manufacturing made by workers in related disciplines, particularly those by the National Electric Light Association, Garver, et al., Thompson,

Creamer, and McLaughlin /19/.

Changes in location or differential rate of growth occur particularly during periods of industrial activity and expansion. During World War II and subsequently, government defense spending has played a major role in location of new factories /20/.

STATISTICAL MATERIALS

Three questions on statistical materials are here considered. What are the criteria that may be used to measure distributions, relative importance, or growth of manufacturing? What are the available statistical and cartographic data? What are the statistical indices by which extent of localization, dispersion, or areal association can be measured?

Criteria Used to Measure Distribution

All data available for the study of the distribution, structure, and shifting of manufacturing have limitations, whether the data be of labor, value added, total value, power, physical quantity of production, floor-space, or capacity /21/.

There are two types of data on labor useful in measuring the distribution of manufacturing: employment figures and occupation figures.
1) Employment figures are reported by each industrial establishment and summaries are published in the Census of Manufactures. Some of these figures include only wage earners though for many purposes the total number of persons engaged in the industry (indluding officials and clerical workers) is what is really wanted. The sharpest limitation, however, is the disclosure rule, which prohibits the U. S. Bureau of the Census from revealing figures that might make possible the calculation of the figures for any one plant.

Thus figures are withheld for cities dominated by a few large factories. This rule insofar as it applies to employment scarcely seems necessary, since such figures are common knowledge locally and often must be reported to other national or state agencies. 2) Occupation figures are obtained by asking each individual what his occupation is; summaries are published in the Census of Population. These are available by a) personal occupation, such as clerical or b) industry group, such as iron and steel. The latter is far more significant for geographic analysis but was not available in convenient form in the United States Census until 1940. Occupational data for most Latin American countries are by personal occupation, which makes their utilization in plotting manufacturing extremely difficult. In general, occupation data are more comprehensive than employment data as they include individuals working as craftsmen; they are, however, a less sensitive measure of non-local industrial activity. Employment data are limited to industrial establishments larger than some stated minimum size, which varies from country to country. A recent map of the industrial regions of India by Trewartha and Verber is based on the number of workers employed in factories /22/.

As noted by H. H. McCarty, Alfred J. Wright, and Victor Roterus, value added by manufacturing is in many ways the best indicator of manufacturing as it is a summation of labor, capital, power, and management /23/. Such data are available for the United States but not for the areal subdivision of many other countries.

Total value of manufactured products has sometimes been used but is a poor indicator because of differences in value of raw materials used and because the final stages of manufacturing are greatly exaggerated as they include the values added by earlier processing, often at a different place, and

often by a sub-contractor.

All value criteria, including value added by manufacture, are difficult to utilize if two or more countries are involved, especially if different periods are to be compared. The shifting foreign exchange rates among Britain, Germany France, the United States, and the Soviet Union, for example, make value comparisons difficult.

Power used in industry by itself doesn't make a good index of manufacturing activity, though combined with other indices as by Helen Strong or Clarence F. Jones it may be valuable.

Physical output provides an excellent base for comparisons within a few specific industries with standarized products such as the iron and steel industry but cannot be used for industry as a whole.

W. Glenn Cunningham found that floorspace was a convenient indicator of relative capacity in the aircraft industry where size of units varied enormously and prices too; it was particularly valuable in periods of peak production.

Capacity is useful in certain industries such as the iron and steel industry, where capacity data are available by individual plants, and where the product is relatively standarized.

All in all, employment is the most widely useful general index. It indicates how many people can make a living from manufacturing. It permits international comparisons. Where value added by manufacture is available, it may be used with great profit. For specific purposes other criteria would be used.

Statistical and Cartographic Data on Manufacturing

The U. S. Bureau of the Census has been the basic source of the statistical materials on which most of the comprehensive studies of distributions and localizations of industries have been based /24/. State directories of industrial concerns are available for a few states. From time to time the Bureau of the Census has published summary statements and maps of the localization of specific industries /25/. The Bureau of Foreign and Domestic Commerce and the Bureau of the Census have published tables on manufacturing industries on a county basis /26/.

These data are valuable but are difficult to summarize by inspection. Meredith F. Burrill produced a handy atlas of manufacturing industries, showing the distribution (by states) of each of the major industries of the United States (1929 data), based on total value of product for each industry /27/. Another series of maps is contained in the volume The Structure of the American Economy; these show detail of distribution better than those of Burrill since they are on a county basis but comparative importance of the various states less well, since each dot represents one establishment regardless of size; graphs, however, indicate the relative importance of the five leading states in each product /28/.

General Statistical Measure of Location

In the volume Industrial Location and National Resources, attempts have been made to measure quantitatively the extent of localization, dispersion, or areal association of manufacturing as a whole or of individual industries in the United States. Suggested measures of dispersion or localization are the coefficient of scatter and the coefficient of localization /29/. The coefficient of geographic association is designed to measure the coincidence

of pattern of any two activities or phenomena (such as manufacturing and total population or flour milling and wheat production, or publishing and total population) /30/. Actually, the coefficient of localization is merely a special case of the coefficient of geographic association, in which the distribution of a given manufacturing industry is compared with the general distribution of all manufacturing. It is particularly valuable in the study of the so-called footloose industries. Often a more valid comparison, however, is that of the distribution of a particular industry with population as in market-oriented industries or with sources of specific raw materials as in raw-material-oriented industries. If the object of study is not a national industry but an area, the location quotient is useful in measuring the relative intensity of location of various industries within a state or other areal unit for which figures are available /31/.

LOCATION THEORY AND LOCATION TYPES

Geographers and economic historians have pointed out the changing qualities of location factors. The significant location factors of yesteryear are not those of today. Nevertheless major industrial areas exhibit remarkable persistence. Many industries owe their original location to factors which are no longer important; persistence of old locations has been described as reflecting "geographic inertia." The successive roles of water power, coal, and electricity as power sources and localizing factors have been described often.

Studies of present localization patterns may be grouped under location theory and location types.

Location Theory

Virtually all geographic studies of manufacturing note sources of

raw materials, sources of power and fuels, labor, markets, transportation connections with raw materials and markets, capital, management, and individual enterprise. We are here concerned with these factors insofar as they play a role in the localization of manufacturing in specific areas, as in the role of available female labor in areas of heavy industry in the attraction of textile industries.

The major contributions by geographers to location theory have been made by Whitbeck, Tower, Hartshorne, Renner, and Colby. On New Year's Day 1909 in a paper before the Association of American Geographers, R. H. Whitbeck presented the first major contribution by an American geographer to an appraisal of location factors in manufacturing industries /32/. He demonstrated the falsity of commonly accepted facile generalizations about the location of industries, such as that the pottery industry of Trenton, New Jersey, was tied to the presence of local China clay deposits. Walter S. Tower in 1911 made a contribution to an analysis of the general factors in industrial localization /33/. In 1927 Richard Hartshorne proposed a quantitative method of appraising the relative force of the three major factors involving transportation (raw materials, power and fuel , and markets), and of labor (in terms of labor cost per ton of raw material, etc.) and emphasized the key role of relative location or locus; his ideas were similar to those of Weber /34/. Recently George T. Renner has noted the important effect of agglomerative economics, which he calls conjunctive and disjunctive symbiosis, depending on whether or not there is an organized relationship among the industries localized together /35/. Colby's geographic study of centrifugal and centripetal forces appraised the relative role of these two opposing forces, toward suburbanization and toward centralization, as they affected industrial localization within cities /36/.

Geographers have turned also to economists and others who have made contributions too numerous to review here /37/. The economists generally have approached the problem of industrial localization by 1) analyzing cost factors in individual industries; 2) attempting to measure the variation in these costs from place to place; 3) by erecting some sort of hypothesis to explain where the industry should be located; and 4) testing that hypothesis by applying it to the actual areas of the earth's surface. The geographers generally have studied first the actual distributions and then attempted an explanation. Particularly noteworthy among economic contributions are the studies of Haig and McCrea in the localization forces within a city /38/, and generalizations of location theory by Alfred Weber and Edgar M. Hoover /39/. Hoover's work is the best American summary of general location theory, but much work is needed to bridge the gap between general economic theory and actual observed distributions. This involves, among other things, the analysis of location types or of specific industries.

Location Types

In 1927 Robert S. Platt essayed a classification of the industries of Puerto Rico based on location types /40/. Three years later, Harold H. McCarty classified the manufacturing industries of Iowa on the basis of location factors; this classification was comprehensive in that it included all the industries for which census returns were available and thus the miscellaneous group was very large, as it is in reality /41/. The U. S. National Resources Committee also made important contributions /42/.

Even if in practice industries do not all fall simply into these location types, their recognition has high geographic significance. 1) Raw-material oriented industries. In these industries the processing significantly

reduces either the bulk or the perishability of the product. Ore concentrating plants, sugar beet factories, creameries, cheese factories, sawmills, and canneries all tend to be located near the source of raw material because the finished porduct is more compact or durable than the raw material and thus easier and cheaper to transport. 2) Some industries are oriented toward the market. In these the processing either increases the bulk or perishability or else must be near the individual customer. Bakeries, ice cream factories, ice works, gas works, bottling works for soft drinks, house construction, and newspaper printing all tend to be near market because the finished product is bulky (houses or soft drinks), or perishable in quality (ice or bread), or interest (newspapers). Many service or repair industries are located at the market in order to serve customers (laundries, automobile repair shops). 3) Some industries utilize local raw materials to serve a local market, though the efficiencies of a large plant often make the service area regional, as in cement works, or large modern bakeries. 4) Some industries are oriented toward power. The general pull of the coal fields is well known. Aluminum reduction and manufacture of synthetic nitrates are examples of power-oriented industries. 5) Some industries are oriented to labor, either cheap or skilled. The machine-tool industry of Cincinnati, for example is said to be related to skilled German labor. 6) Many industries are complex in their locational attributes, the automobile industry, for example. When it is realized that only 20 per cent of the materials utilized by American manufacturing industries are unprocessed raw materials, and that only a small portion of manufacturing industries produce directly for consumers, it is easy to understand that the agglomerative relations of one industry to another are often the key factor. This factor, perhaps as much as that of cheap fuel, underlies the

concentration of industries on coal fields; it is the basis of the snowballing effect of industries in the largest cities and of the increasing dominance of metropolitan districts.

A good description of a series of industries each with a range of successive locations ranging from raw material orientation in early processing through intermediate location to final finishing near the consumer is given in The Structure of American Economy /43/.

STUDIES OF SPECIFIC INDUSTRIES /44/

Except in textbooks, there has been comparatively little written by American geographers on individual manufacturing industries as a whole. Most studies are limited to a specific industry in a given city or region or country. The earliest major general geographic survey of a series of industries on a world-wide scale was made by J. Russell Smith in 1913 in his book Industrial and Commercial Geography /45/. More recently Erich W. Zimmermann has written a valuable analysis of major industries /46/. The first article in a geographical periodical on a specific industry taken as a whole (i.e. not limited to any one area or country) did not appear until 1917 /47/, but from 1927 on geographers made many contributions to the study of specific industries. In general the basic industries have been better studied than the more complex machinery industries. The studies often have been concerned with factors in the pattern of distribution or localization.

The iron and steel industry has been a favorite among geographers for studies of factors in location. The raw materials are bulky and few in number with the result that the exact cost of transportation for all raw materials can be determined for the actual or potential centers or production. The finished products, in part at least, are bulky, standardized, and

competitive, with the result that transportation costs to markets can be calculated also. Numerous studies of individual iron and steel centers or large districts have been made by Appleton, Blanchard, Brush, Erselcuk, Frey, Hartshorne, Ieard, Love, Rodgers, White (partly in collaboration with Foscue and Primmer), and Zierer /48/. The most detailed study of an American iron and steel district is that by Appleton on the Calumet District of Chicago /49/. Otis W. Freeman in 1923 listed the factors in the location of iron and steel mills /50/. The best critical geographic summary of location factors in the industry, however, was written by Richard Hartshorne in 1928 /51/. He took full account of variations in quality of the raw materials and of relative location of the raw materials and the markets. He evolved valid location types, which could be illustrated by specific actual centers.

The location of the cotton textile industry, interesting because of its striking migration, has been examined by no less than four published doctoral dissertations in geography. Rollin S. Atwood studied the localization in Lancashire, England; J. Herbert Burgy, in New England; Thomas R. Smith, in Fall River, Massachusetts; and Ben F. Lemert, in the Southern Appalachian Piedmont /52/. The study of the industry in Orizaba, Mexico, by Alice Foster is also worthy of mention/53/.

Among the geographic studies of location of individual industries, Cunningham's monograph on the aircraft industry is outstanding /54/. It was primarily a case study of the varying location patterns in an industry which has undergone major rapid location changes in recent times.

STUDIES OF INDUSTRIAL AREAS

The earliest scholarly American papers on the geography of manufacturing were concerned with manufacturing in specific areas, and the geographer

frequently has been at his best when interpreting the relationship of manufacturing to a particular region. It has been noted by Hartshorne that the geographer should study the internal relations of manufacturing in an area to other elements, both cultural and physical, within the area itself and also external relations to other regions. These relations find expression in labor, tax, water, power, zoning, planning, and other political and social interrelationships with the community, and in flows of materials from farms and mines to factories, from factory to factory, and from factory to market.

Notable early papers are by R. H. Whitbeck, Malcolm Keir, and George B. Roorbach. Whitbeck early made the basic generalization that as a region develops, its industries become more and more diversified and its dependence on local raw materials less and less; thus Wisconsin industries in 1912 in contrast to those of New Jersey were closely tied to local raw materials /55/. Malcolm Keir's analyses of New England industries were interesting in their recognition of the differing locational roles of changing power sources; industries which arose in the period of water power were localized at inland sites, those which arose later in the period of steam power (from waterborne coal) were on the coast /56/. He also essayed a general interpretation of the role of the sea in the industries of New England. George B. Roorbach noted that both local resources (water power) and accessibility to coal, raw materials, and markets were important in the rise of industries in the Mohawk Valley /57/.

More recently, the trend in geographic studies of specific areas is revealed by four doctoral dissertations by Alfred J. Wright, Alden D. Cutshall, Herman F. Otte, and John Alexander /58/. Wright studied industrialization of the Middle Miami Valley (Ohio) at various stages in the development of the

(canal era, railroad era, etc.) and attempted to recognize the forces in the changing locations. Cutshall's study of the Lower Wabash Valley (Indiana and Illinois) is similar to Wright's in noting the decline of smaller industrial centers (with decline in rail service) and the decreasing importance of local raw materials (cf. Whitbeck). Otte's study of the Tennessee Valley of Northern Alabama is primarily an appraisal of the possibilities of the development of manufacturing industries in a Southern area, not part of the manufacturing belt. Alexander's study of the Rock River Valley, Illinois and Wisconsin, on the western margin of the Manufacturing Belt emphasized the human factors responsible for the early indigenous development of manufacturing in the valley and for its continuation there. He noted that slightly higher transportation costs here are offset by slightly lower labor costs.

Less extensive studies have been made of areas on the edge of the Manufacturing Belt or outside it altogether. J. Russell Whitaker studied the northern edge of the Manufacturing belt in Canada /59/. During World War II Freeman and Raup attempted to appraise the trends in the outlying area of the Pacific Northwest /60/. More recently James J. Parsons studied the industrialization of the two outlying industrial areas of California and the Gulf of Texas and Louisiana /61/. He found in California, that although growth in industry has been rapid, it has not kept pace with population growth (much of the industry is market-oriented), whereas in the Gulf South industrialization has been more rapid than population growth. The dominant chemical industries on the Gulf Coast are oriented toward raw materials of petroleum and natural gas with huge capital investments but only moderate labor requirements.

The studies of foreign industrial areas are few. Preston E. James mapped and described the distribution of industries in a state in transition from

local handicraft to urban factory production in Sao Paulo, Brazil /62/. Hoffman appraised the raw material position of Austria and the potentialities of industrial development and stability /63/. The outstanding study of a foreign industrial area, however, is that of Japan by John E. Orchard /64/.

Many studies have also been made of individual industrial cities. Early studies, illustrated by Keir's paper on Philadelphia, were particularly concerned with the factors in the development of industries in one city /65/. Margaret T. Parker's study of Lowell, Massachusetts, contained a characterization of the industrial stamp of the city and summarized the evolution and the factors in the location of industries in the city /66/. Bernard H. Schockel's monograph on Evansville, Indiana, was primarily a study of the evolution of manufacturing in an Ohio River town, but is of general interest in its attempt to ascertain, map, and describe the trade patterns in the sources of materials used in Evansville factories and in the destinations of the products of these factories /67/. Contrasted types of treatment are offered by Harold Miller's study of New Albany, Indiana, which treats sequent occupance in terms of three eras and the study of Seneca Falls, New York, by J. Norman Carls and Walter W. Pistow, which treats each industry in turn /68/. Robert L. Wrigley described organized industrial districts as illustrated by such districts in Chicago /69/. Roterus has discussed the future industrial land requirements in the Cincinnati area /70/.

EXPLANATION AND PREDICTION OF INDUSTRIALIZATION

It is one thing to recognize a phenomenon such as the American Manufacturing Belt, and another thing to explain it. Sten De Geer attempted to explain the location and limits of the Manufacturing Belt. The attempt was laudable but to this day a thoroughly critical, comprehensive, and balanced

evaluation of the factors in the localization of manufacturing in this area is lacking.

Textbooks frequently have elementary notations on the differences of industrialization in various parts of the world, but very little detailed research has been done on the significant but difficult subject of the factors underlying such differences. Preston E. James attempted a brief appraisal of the state of industrialization in Latin America /71/. John E. Orchard sought to determine the factors inhibiting the industrialization of China as compared with Japan and to appraise the potentialities of Japan for industrial development /72/. At the onset of rapid Soviet industrialization under the five-year plans, S. S. Visher attempted to evaluate the potentialities of the Soviet Union in manufacturing /73/. Nevertheless there is not yet available a really satisfactory geographic appraisal of the factors underlying differences in industrialization over the face of the globe, nor indeed of the potentialities of major regions for industrial development.

There is now a great flurry of interest in the industrial development of the underdeveloped areas of the world but unfortunately very little is known about the potentialities of these areas for industrialization. Here is one of the major socially significant frontiers in the subject of manufacturing geography, but also a difficult and complex one.

PROBLEMS NEEDING STUDY

Problems needing study may be grouped under five major heads: Industrialization: its role and possibilities; Distribution of manufacturing; Impact of new techniques; Functional interrelationships; and Practical application of studies in geography of manufacturing.

1. Industrialization: its role and possibilities.

1. What is the contribution of manufacturing to community, regional, or national development? To what extent is industrialization a cause of improved living standards and to what extent a mere effect? What is the relationship of various types of manufacturing to community welfare, as for example in employment stability as studied by Victor Roterus /74/. What is the number of persons supported in secondary and tertiary activities for each person in a basic industry, i.e. what is the multiplier effect of the development of a basic industry? Harold V. Miller has used the ratio of two workers in trade and service industries for each worker in a primary industry and two dependents for each worker to arrive at an estimate of a community population increase of 900 for each increase of 100 persons employed in basic industry /75/. This paper is an important step in the right direction but detailed studies are needed, as this ratio doubtless varies from one economic system to another. What then is the relationship of manufacturing to general population growth and urban growth /76/.

2. What are the factors in the rise of industrialization of various areas? Why have some areas industrialized rapidly and others only very slightly? Is it a matter of markets, standards of living, cultural and technical level, natural resources, locus, transportation, individual initiative, labor, climate, history, or of various combinations of these varying in time and place? What is the role of cultural differences, if any, in the type and extent of industrialization in China and Japan, in Latin-America and Anglo-America, in Germany and the Soviet Union, in Britain and India?

3. What are the possibilities for industrialization in new areas? The desire for industrialization is widespread and, partly at least, rational.

Non-industrial cities and states in the United States, several agricultural countries with high standards of living, and underdeveloped areas the world around are affected by the urge for industrialization. What types of industries can be developed? What is the experience of stimulated industrial development in similar areas in the past? Tariffs, import restrictions, subsidies, capital investment, tax policies, and technical aid from more developed areas are all looked to as helps. Are they sound? Are they likely to be effective?

II. Distribution of Manufacturing

1. What is the likely course of future shifts in areas of industrialization over the next several decades: migration to non-industrial areas, flight from industrial cities to suburbs, shifts to different industrial areas? As some industries use more and more machinery are their locational attachments likely to shift?

2. What is the relative rate and extent of dispersion in the United States under a capitalist system with strong but uncoordinated governmental influence especially in time of national crisis and in the Soviet Union under highly centralized comprehensive governmental ownership, planning, and operation?

3. What is the desirable areal pattern of industrialization? Is there an ideal pattern?

4. What role should public policy play in industrial localization? Should new industries be brought to existing centers of labor, or should labor be brought to new sources of power as in the Gulf Coast, or should power be moved to existing centers as by new natural gas pipelines? Should governmental policies aim at well-rounded regional development or at regional

specialization? The exploratory work of Edgar M. Hoover in this field needs to be pushed further.

5. What are the likely effects of military and security consideration on future industrial location in large cities, established industrial areas, and in coastal or frontier areas? Comparative studies of countries of continental dimensions such as the Soviet Union and the United States and of the small countries of Western Europe might be instructive.

6. What is the relative importance of manufacturing in the economies within each of the countries of the world? And what is the relative importance of each country in manufacturing?

7. What is the relation of localized and ubiquitous industries and how can they best be separated in the statistics and mapped?

III. Impact of new techniques.

What is the likely geographic effect of changed techniques, facilities, resources or administration: atomic energy /77/, new oilfields (as in the the Near East), increasing efficiency in use of fuel, a national electricity grid as in the United Kingdom, far-flung natural-gas pipelines as in the United States, use of diesel-electric locomotives, increased use of bulk ocean carriers, a zonal freight-rate structure as in parcel post, the St. Lawrence Seaway, proposed belt conveyor for coal and iron ore between the Great Lakes and the Ohio River, depletion of high-grade iron ores of the Mesabi Range, use of taconite in the Mesabi Range, development of Labrador ores, approval of the Schuman Plan in Europe, steel production without use of coke, new synthetics such as nylon, rubber and plastics, possible European Union, and independence of colonial lands.

IV. Functional interrelationships.

1. What are the relations of industries with each other?

2. What are the interregional relations of industries in terms of actual flows of raw materials and finished goods?

V. Practical application of studies in geography of manufacturing.

What are the ways in which the work of geographers may be applied to specific applied problems? Harold V. Miller, Executive Director of the Tennessee State Planning Commission, and Victor Roterus, Chief of the Area Development Division in the U. S. Bureau of Foreign and Domestic Commerce, have pioneered in the application of geographic techniques to current locational problems in manufacturing. But the field is wide open for other enterprising geographers.

By way of conclusion it may be noted that there have been great advances in the study of the geography of manufacturing, particularly during the last 25 years, but that there are many challenging problems still confronting the scholar in this field.

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30. The coefficient of geographic association is the summation for all States of the positive differences between the State percentages of workers (or production) for the U. S. in any given industry and the percentages in any other activity chosen for comparison. (ibid., p. 118 and Table 3, p. 119).

31. The location quotient is obtained by dividing the share of a State in the U. S. national total for a given manufacturing industry by its share of all manufacturing. (ibid., p. 107 and Table 2, pp. 108-119). Thus the location quotient for newspapers in the Mountain States is 3.50 and for Illinois 1.03, not because newspaper publishing is more important in the Mountain States but because other manufacturing activities are less important. Ubiquitous industries show high location quotients in non-industrial states and very low ones in industrial states. In such cases, a base of the population would be more illuminating than a base of all manufacturing.

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MARKETING GEOGRAPHY

Introduction

Marketing geography is a field of applied economic geography. It is geographic knowledge organized for use by those who strive to achieve greater efficiency in the distribution of goods and services from producer to consumer.

The objective of the marketing geographer is to acquire and develop professional competency and to employ this to the end that the marketing function can be improved, and thereby contribute to a more abundant life for all.

To date this is still a virgin field whose value has hardly been brought to the attention of business, in spite of its practical potentialities /139/. Most of the marketing geography work done is the product of researches and practitioners in other fields. There is no organized literature of principles and methodology. What has been published is largely spotted in the literatures of geography, economics, marketing, statistics, city planning, sociology, and business. There is no comprehensive bibliography /140/.

This presentation is a pioneer attempt to sketch the field of marketing geography. It is presented as a framework, not as a definitive exposition. The door is open wide for others to enter and rearrange, modify and amplify. Let this be an inducement to them to cultivate the field, conduct research, develop principles, stimulate the application of their findings, and harvest reward for their labor.

Scope

Marketing geography is concerned with markets and with channels of distribution.

Markets are existing or potential consumers of goods and services within a geographic area. Consumers are individuals, business establishments, and

institutions. All economic activity is geared to meet present and potential demands of consumers; hence the concern with markets.

Channels of distribution are the various economic organizations which perform a function in the transfer of goods and services from producer to consumer. These include wholesale, retail and service establishments. The magnitude and importance of this network of distribution channels in the United States are conveyed by the following statistics./ 141/.

Channels of Distribution	Number of Establishments	Paid Employees and Proprietors
Wholesale	244,000	2,600,000
Retail	1,771,000	8,800,000
Services	665,000	2,800,000
Total	2,680,000	14,200,000

Markets and channels of distribution are real physical entities. They are located on specific, mappable points on the earth's surface. But they are not static. Change is continuous in number, size, requirements, functions, organization and location. Geographic factors are significant and play a part in this evolutionary process.

In studying markets, the geographer's primary concern is where these markets are. He is interested in the distribution of individual or specific consumers, and in the magnitude of consumption or sales potentials within different areas. Such areas may be geographic regions, branch sales territories, metropolitan districts, salesmen's territories, trading areas; or, they may correspond to political areas, such as countries and their various administrative subdivisions.

The demand for some goods and services is highly specialized and the number of users is relatively small. For other goods and services, the demand is very widespread. Some products are consumed essentially where produced, others at great distances from the source of production. Differences in demand

can be traced to economic, social, technologic and geographic factors.

Considerable effort and money is being spent by business, government and institutions of learning on studies of markets and marketing. Yet the surface has barely been scratched. There is much to be done, and the geographer can make an impressive contribution. First, he can help ascertain, map, analyze and interpret various consumer characteristics. He is also well qualified to examine the significance of the geographic factors in consumption and in customer buying behavior patterns. Furthermore, he is especially able to delineate market areas, point out regional and local variations, and help evaluate their potentials.

In studying channels of distribution, the marketing geographer's primary concern, again, is where these channels of distribution are. Having ascertained this from whatever sources available, the geographer can go further. He can determine the trading areas served by the various channels of distribution. He can examine the transportation networks and facilities used and the advantages which might be gained by changes. Also, he can evaluate locations of and for channels of distribution.

The geographer, in making such studies, must always seek to discover the significant problems presented to the various channels of distribution by the geographic environment within different market areas or regions, and the manner in which these problems are being met. This implies a prerequisite knowledge of the functions performed by the various channels of distribution for the producer and consumer, and the nature and extent of competition between and within these channels of distribution.

While the marketing geographer detached from business can do some useful work in this field, he can hardly come to grips with concrete problems, which

when solved will result in a more abundant life for all, unless he works directly with business. The optimum habitat for marketing geography is in business. Therefore the marketing geographer should either work for business full-time or should seek to conduct research for business on a part-time, consultant basis. Many problems in marketing geography cannot be studied without the private information and facilities possessed by business. Similarly the application and test of ideas and principles need the laboratory of business. And, there is the worth-while consideration of monetary reward.

Application

Every industry, every agricultural region, every channel of distribution, and every individual business and farm has its special marketing problems. Thus there is almost no end to the number of marketing problems. Theoretically the geographer can render help on every one of these. As a practical matter few will avail themselves of the geographer's help. Certainly the neighborhood grocer and barber will manage without the services of the geographer, the market researcher, or the government census taker. Yet, in the long run, even the neighborhood grocer and barber can be benefited.

The marketing problems to which the geographer can best apply his talents can be grouped, for convenience, under four subheadings.

1. Presenting market and marketing data
2. Evaluating markets
3. Delineating trading, selling, and sampling areas
4. Selecting channels of distribution and location

The basic considerations of each of these subheadings can only be sketched briefly in this presentation.

2. Presenting Market and Marketing Data

Since the geographer maps all sorts of phenomena, it is a comparatively simple task for him to map expertly market and marketing data. The nature of these data depends on the subject or problem involved.

The distribution of present or potential consumers is always of paramount importance, but these vary greatly with different products and services. The market for cotton picking machines is different than for tractors, even though the two may overlap in some areas. The United States market for home deep freezers is obviously different than for hospital beds. The former, among other things, is dependent on the availability of electricity; the latter is primarily confined to the distribution of hospitals.

In the majority of market studies the number, composition, purchasing power and distribution of population are basic factors. Even though an impressive job has already been done (by non-geographers) in presenting the population factor, a great deal more can and should be done. Marketing specialists would welcome a comprehensive population atlas of the United States. Such an atlas should map not only as many characteristics of population as can be compiled and are significant marketingwise, but should also relate the distribution of these characteristics to other geographic factors. This is a big subject - and perhaps a dream for the present - but some day it should be a dream come true, and one which will be regularly revised and improved.

Factors other than population are of primary importance in the marketing of many products and services. For example, a distributor of block salt is interested in the distribution of the cattle population, and a manufacturer of milking machines in the distribution of dairy cows. In marketing products and services used only by industry or business, the distribution of the particular

users of each product or service is a major factor.

Marketing data of course include channels of distribution: wholesale, retail and service establishments. These also embrace warehouses, storage facilities of various types, headquarters and branch offices of large companies, salesmen's territories, delivery routes, etc. The geographic distribution of these by type, size and ownership, and the trading or service areas of each, are all necessary marketing data which the geographer can and should map.

Most of the standard geographic phenomena which the geographer maps, such as terrain features, soil, vegetation, climate, land use, location of mineral resources, industries, settlements, types of farming, arteries of traffic and transportation, communication systems, etc., are significant to marketing in various ways. At present, however, neither the geographer nor the marketing specialist always understands, especially quantitatively, this significance. For example, it is generally recognized that climate and weather affect consumption and buying habits, but little has been done to date to correlate these factors quantitatively. Nevertheless, the marketing geographer should consider for presentation all geographic factors which are known to be significant.

Finally, the marketing geographer should not only present marketing data, but he should also find new opportunities for using these. A great deal of mapped data already exist, prepared for one purpose or another, but not specifically for the use by marketing specialists. These should be ferreted out, examined and evaluated from the standpoint of their potential value to marketing. This too is no small task. It requires knowledge of existing map information as well as a factual knowledge and imaginative appreciation of marketing problems. Perhaps this is a task for the joint endeavors of marketing geographers, market researchers, and others.

2. Evaluating Markets

The fundamental purpose in evaluating markets is to ascertain or approximate future sales potentials for a product or a service. The sales experience of the past and many other indices are employed as measurements. For new products there may be no past sales experience to serve as a guide, and conclusions have to be inferred entirely from other types of data.

In evaluating markets a dynamic approach is necessary. The expansion of industrial and agricultural production, the growth and shift of population, the discovery or exhaustion of natural resources, the spread or eradication of pests and disease, the occurrence of floods, hurricanes and other disasters all contribute to change the market potentials of one area or another. Some of these changes may be slow and gradual, as the overall economic decline of a large geographic region. Other changes may follow rapidly, as in the tapping of a new supply of water for irrigation of an arid region. Such a major change will set off a chain reaction in marketing potentials. Similarly the discovery of a new use of an ore or the development of a radical method for processing an ore may result in drastic changes in the consumption potentials of affected mining and smelting communities. Other examples could be proliferated.

Thus the marketing geographer must concern himself with what has been, is, and is most likely to be the marketing potential of an area within a given period in the future. Adequate data for reconstructing the past picture may not be available, or may be of a static nature, as of a certain fixed moment. Information regarding the future may be confused or uncertain. In spite of these difficulties an attempt at evaluation must be made. An inteiligent guesstimate is better than complete lack of understanding. The businessman must make his marketing decisions on the information available to him.

Frequently even the best is not very good. Usually the marketing geographer should be able to help shed some light on the marketing prospects of an area. Obviously, to do this he needs a foundation in all aspects of economic geography, and a knowledge of the research methods and statistical devices employed by market researchers.

The total market for a product or service is finite. Even though one company claims in its advertising that its products "cover the earth," every geographer knows that only a small portion of the earth's surface is inhabited by man. And where there are no people with purchasing power there are no markets. The task, therefore, is to study the total market for a product or service and to differentiate the various parts or segments. The approach may be to evaluate the parts and combine these into a total.

Whether the parts of a market are large or small there are likely to be regional variations. These variations arise from differences in number of users and types of uses, distribution systems, market coverage and competition. But there are also bound to be many similarities and fundamental uniformities. These constants are as important, and perhaps even more important, than the variations. However, without regional or market area differentiation it is not possible to ascertain which elements of consumption or demand for a product or service are ubiquitous and which are peculiar to certain areas.

Market evaluation may involve established or new markets. New markets mean new consumers. These have to be found before they can be evaluated. They may be located in areas already tapped by a product or service, or they may represent altogether new territory.

Business organizations must plan their activities. Such plans presuppose objectives or goals. The sales goals of a business are generally expressed as

"sales quotas." Such quotas are set 1) for the company as a whole, 2) for its various sales divisions and selling units, and 3) for geographic areas. The sales effort to be di. cted to achieve these goals must correspond to the potentials and problems of each market area. Hence the importance of market evaluation for setting sales quotas.

3. Delineating Trading, Selling, and Sampling Areas

The trading area of a business establishment is the geographic territory from which it draws its customers and obtains its sales. Since retail, service and wholesale business establishments tend to be grouped in clusters or shopping centers, each shopping center, town, or metropolis has its trading area.

That trading areas of different business establishments and shopping centers vary in size and exert a business gravitational pull, is common knowledge among students of this subject. Various methods have been developed to ascertain from customers' addresses and other data the extent of these trading areas, and to delineate them on maps. The "precise" boundary lines which are drawn generally are a product of compromise and approximation. Trade does not halt abruptly along such boundary lines, as a rule. There are, however, geographic factors which affect the extent and configuration of trading areas. These are not always recognized or taken into account by researchers lacking appropriate geographic training.

Intensity of density of coverage within a trading area is not uniform. These intra-territory differences are important for pinpointing marketing effort. The impact of competition from without is strongest on the buying behavior of customers living along the periphery. The configuration of a trading area does not remain permanently fixed, so that delineations must be checked and revised periodically. Studies of various customer buying habits

frequently conducted in delineating and evaluation trading areas, and to discover significant changes in buying patterns. Changes in channels of distribution, arteries of traffic and mode of travel affect customer buying habits.

Selling areas or sales territories are geographic units delineated and set up for business administrative purposes so that sales effort can be directed effectively. A selling area may be a milkman's route, a salesman's territory, or the vast domain of a major division of a far-flung business.

The basic objective in regionalizing the marketing functions of a large business is to achieve maximum sales at a profit. Adequate geographic coverage without overlapping, at a reasonable cost and with fair compensation to salesmen or other channels of distribution must be considered. It is also desirable that each sales territory should be fairly homogeneous. Territories should be approximately comparable with respect to a selected set of factors so that measurement of performance can be meaningful.

Sales effort requires direction and supervision, hence there is the consideration of regionalizing territories to achieve effective supervision. Retail chain store organizations, especially, are faced with this problem. Still another requirement is the laying out of delivery zones or routes with the view of holding down to a minimum the number of trips, travel miles, wear and tear of equipment, and delays in delivery schedules due to traffic congestion, weather and road conditions.

Regardless of the type or specialized purpose of a sales territory, the size and shape of each within a given type are very important factors. Size and shape involve distance, and distance implies time, effort and expense. Therefore, in delineating sales territories a balance must be achieved between the different complementary and conflicting elements. In so far as it is

possible precise, statistical measurements should be used in laying out and delineating sales territories.

Sampling areas are small, representative segments of a statistical universe. Such areas, either individually or in combination, are supposed to contain on a small scale, proportionately, all of the characteristics of the entire universe. They are used as specimens or laboratories by researchers in many fields.

In marketing studies, sampling areas are used as specimens to determine specific, existing consumer and distribution characteristics. As laboratories they are used to conduct tests and experiments in connection with developing and introducing new products, new methods of distribution, and new sales promotional devices. The results of such studies serve as a guide to marketing decisions and action.

Usually it is either impossible or impractical, **costwise**, to consider all factors which might be significant in developing sampling areas. As the geographic size of the total market increases, the difficulties multiply. In actual practice, only certain diagnostic features or elements are selected as a basis for determining and delineating sampling areas. These elements are either known to be, or are believed to be, most significant. For example, an assignment involving the marketing of milking machines, cream separators, or cream cans may consider the following elements of major significance in selecting sampling areas: number of dairy cows, size of farms by number of dairy cows, milk production per dairy cow, and farm ownership status.

As previously stated, markets and channels of distribution are real, mappable entities; therefore a geographic point of view in the approach to the complex problem of area sampling is indispensible.

4. Selecting Channels of Distribution and Locations

To a considerable extent the success of a manufacturer or producer depends on the channels of distribution which he selects for selling his goods. The farmer who peddles his produce direct to the housewife and the Fuller brush man who canvasses the neighborhood are both selling direct from producer to consumer. Many products used by industry are sold directly. Most goods, however, follow a less direct course of distribution and go through several channels before reaching the consumer.

The manufacturer must make two fundamental decisions in selecting his channels of distribution. He must first decide through what type of channels his goods are to be sold, and he must also choose the specific establishments within each type which are to handle his products. The channels of distribution selected must give him satisfactory market coverage and distribution costs.

After the original selection of channels has been made, the manufacturer must continue to amplify and revise his choice. One dare not stand still in a dynamic distribution environment. And always there is the search and drive for wider geographic coverage, more sales, better service, lower costs and greater profits. Thus there is a need for constant review and research.

Agricultural producers, too, have to select channels of distribution for their goods. The range of choice may not always be wide. Here the problems are to a large degree regional problems. What affects one farmer generally affects other farmers of the same area. Satisfactory solutions may require organized cooperation.

Another consideration which falls logically into the category of selecting channels of distribution arises when a distributor desires to expand his range of marketing operations. For example, Sears, Roebuck and Company was

originally developed as a mail order business. To take greater advantage of the urban market, it subsequently added a vast chain of retail stores. Many wholesalers have expanded to perform retailing, while some retailers have also gone into wholesaling. In all these instances an additional channel of distribution was selected as a complementary activity to increase overall sales. The products handled may be identical or somewhat different within each channel of distribution operated by the same company.

Finally there is the problem of selecting locations for wholesale, retail and service establishments. This problem involves two considerations: 1) to select the region, city or shopping center which offers opportunities and 2) to choose the particular site or sites for setting up an office, warehouse or store. Here it is not enough merely to find areas of opportunity and suitable sites, but one must also undertake to estimate in advance potential sales and operating costs for each proposed installation. A company's own experience in similar locations, or competitors' experience, are valuable guides. But this implies a comparative knowledge of markets, trading areas and competition. Without such knowledge, comparative locational characteristics cannot be identified and evaluated quantitatively. And without quantitative yardsticks there can be no scientific approach for estimating in advance a location's potentials.

The marketing geographer can help business select channels of distribution and locations. There seems little need for elaborating this statement at this point, in view of what has already been said about his qualifications for presenting market and marketing data, for evaluating markets, and for delineating trading, selling and sampling areas.

Techniques

In the pursuit of his work the marketing geographer employs all research techniques which are applicable to the problem. Some of these techniques, such as cartographic presentation and description of geographic factors, are his special forte. Other techniques, such as statistical methods, cost analysis, questionnairing and consumer behavior research, he acquires from other disciplines.

Just as skill in geographic techniques is not acquired without a solid background in geography, so it is necessary for the marketing geographer to acquire at least a fair knowledge of the principles and methods of economics, marketing research, and statistics, and some knowledge of accounting theory and practice. Having done this, the marketing geographer should blend these techniques with those of geography. Better research and more valuable results can be derived from such cross-fertilization of disciplines and techniques.

Cartography as a tool has practically unlimited possibilities in presenting market and marketing data. Good as his present skills are, the marketing geographer needs improved analysis and even new cartographic techniques in presenting quantitative data. The devices of color (or shading), dots and isopleths are all excellent within their limitations. Further experimentation, ingenuity and imagination are needed to enhance their usefulness. There is also a need for standardizing symbols and inventing new ones for presenting market and marketing data. For example, there is no standard symbol for a warehouse or a metropolitan city.

Present methods in delineating market areas, trading areas and sales territories are still very crude. By and large the results produced are not even good approximations. Most of what has been done is marked by intrusions

of strong subjective or current notions of untested merit. Yet this is the best available, and of necessity one must make the most of what is at hand. No doubt this situation reflects adolescence, as a scientific approach to such areas delineation is of very recent date. Also, aside from the cost factor, lack of sufficient or adequate data has hampered the quality of the delineation. Finally, much of this work has been done without assistance from expert geographers. Here, then, lies a splendid opportunity for creative geographers to advance the techniques of area delineation.

There is a substantial, descriptive geographic literature on the location of industry and commerce. But there is very little in this literature to enable a geographer to select a location and evaluate its potentials quantitatively, in advance of the installation of the business establishment. Specific techniques and quantitative standards of measurement are needed. A beginning has been made in developing such research tools, but only a beginning, and not all of this by geographers. Much remains to be done. Quantitative standards will have to be worked out for each type of business, and then periodically revised. It is a big job which can only be carried out with the support of business.

Finally, marketing geographers must develop and cultivate techniques for educating or "selling" businessman on the value of geography to business. Geographers may not be prepared for such enterprise. Fortunately this is not a congenital handicap.

Conclusion

Whether marketing geography is a science or an art, or a blend of the two, is of little consequence. What is important is this: marketing geography can render a valuable service to business and to society by contributing

knowledge necessary for intelligent marketing decisions in the solution of problems encountered in the distribution of goods and services from producer to consumer.

Whether geographers are interested and appropriately prepared to work in this field is of major significance. Marketing geography will achieve its full stature only when a substantial number of properly qualified geographers apply their talents and energy to developing this field.

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139. Applebaum, W. "The Geographer in Business and His Requisite Training," The Professional Geographer, April, 1947.

140. Ristow, W. W. has compiled recently an annotated list of Marketing Maps of the United States, obtainable from the Card Division, Library of Congress, Washington 25, D. C.

141. U. S. Census of Business - 1948. These channels of distribution and the various sub-types of business organizations functioning under each, are defined by the U. S. Census.

OTHER BRANCHES OF ECONOMIC GEOGRAPHY

The preceding sections of this chapter have been concerned with the best developed topical branches of economic geography. These were selected for special treatment because enough work has been done in each so that it is generally recognized as having a literature of its own, fairly distinct concepts or generalizations, and men who are regarded to some degree as specialists.

Obviously, there are other possible lines of concentration within economic geography. The geography of international trade or commerce was the subject of numerous articles in the early decades of this century /179/ but has declined as a field of specialization.

Recreational geography is a promising line for research. It is a specialized form of marketing geography, the marketing of locational advantages. A number of years ago McMurry, reporting on the work of the Michigan Land Economic Survey, called attention to the importance of recreation as a form of land utilization /180/. Later, Jones made an interesting start in the geography of recreation through his classification of the resorts of the Canadian Rockies /181/, and Carlson studied recreation in New Hampshire /182/. Several studies of tourism have appeared in the published literature of the last decade, but they have added little to the basic concepts of recreational geography.

For work in recreational geography the lack of statistics is a serious handicap. The United States Census does not publish recreational data, and state and other local agencies generally do not collect the sort of information along this line that the geographer needs. Sometimes the resourceful worker may discover a unique source of data. A recent analytical study by Wolfe, based on Canada Post Office lists of the home addresses of summer cottagers, shows what can be done where such a statistical source is unearthed

/183/. But since so few data are collected by official agencies it will often be necessary for the recreational geographer to use sampling methods if he is to follow effectively his chosen line of work.

Several other potential topical specialties may be mentioned. One of these is the geography of commercial fishing, which has been the subject of a number of articles by American geographers and of one notable book /184/. Forest utilization is another topic that appears to have promise, although it has not been made a subject of specialization by any American economic geographer. And there are various other possible topical specialties in economic geography that may occur to the reader of this book.

Of course, economic geography itself is a topic, and a number of studies may be cited in which the attempt has been made to cover all aspects of the economic geography of an area. Such studies have ranged in scope from those dealing with large countries or even continents to studies of very small areal units /185/. They add materially to our store of regional information, but the carrying out of such general studies, even when they represent the application of detailed field methods to small areas, is hardly in itself a field of specialization in economic geography. Instead, the best examples of such studies have been the work of geographers who are attempting to gain an understanding of a larger regional unit in which they are specializing.

179. See, for example, Roorbach, G. B. " The Import Trade of the United States," Economic Geography, Vol. 2 (1926), pp. 230-243.

180. McMurry, K. C. "The Use of Land for Recreation," Annals of the Association of American Geographers, Vol. 20 (1930), pp. 7-20.

181 Jones, S. B. "Recreational Regions of the Canadian Rocky Mountains" Bulletin of the Geographical Society of Philadelphia, Vol. 34 (1936), pp. 50-72.

182. Carlson, A. S. "Recreation Industry of New Hampshire," Economic Geography, Vol. 14 (1938), pp. 255-270.

183. Wolfe, R. I. "Summer Cottagers in Ontario," Economic Geography, Vol. 27 (1951), pp. 10-32.

184. Ackerman, E. A. New England's Fishing Industry, Chicago, 1941.

185. See the following examples: Currie, A. W. Economic Geography of Canada, Toronto, 1945; Whitbeck, R. H. Economic Geography of South America, New York, 1926; Starkey, O. P. Economic Geography of Barbadoes, New York, 1939; Trewartha, G. T. "A Geographic Study in Shizuoka Prefecture, Japan," Annals of the Association of American Geographers, Vol. 18 (1928), pp. 127-259; Hall, R. B. "The Yamato Basin, Japan," Annals of the Association of of American Geographers, Vol. 22 (1932), pp. 243-292; Murphy, R. E. "The Economic Geography of a Micronesian Atoll," Annals of the Association of American Geographers, Vol. 50 (1950), pp. 58-83.

CONCLUSIONS

We have found that economic geography from a research point of view is not so much a field as it is a group of fields or specialties. Some six or seven such specialties have been described, each with its own workers and its own expanding literature, and more are in the making. This very proliferation is a hopeful sign, indicating, as it does, the virility of the subject.

Accompanying this expansion of economic geography have been certain general trends. For one thing, the static point of view has given way before the realization that the economic picture is one of constant shifts and changes. The division into specialties has helped, too, to focus attention upon possible practical applications. Each specialty that has been described has its theoretical aspects, but in each there are workers who are asking, "How can our efforts or those of our students be of specific practical value in business and planning? And certain broader questions arising, questions that transcend any one specialty, such as, for example, can we estimate the economic capacities of nations?"

Much has been done but vastly more remains to be done. In some branches of geography, as in several phases of physical geography, the front is being pushed forward by men in government employ. In anthropology, to take an example from outside of geography, support from foundations is often available. But research in economic geography is almost entirely the spare time effort of people who must depend upon teaching for their livelihood. More man-hours of research are needed, more men who can devote full time to their research. This is a handicap that must be overcome if economic geography is to live up to the vigorous promise it has shown thus far.